Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

SD11
.A48

United States
Department of
Agriculture

Forest Service

**Intermountain
Forest and Range
Experiment Station
Ogden, UT 84401**

General Technical
Report INT-177

March 1985

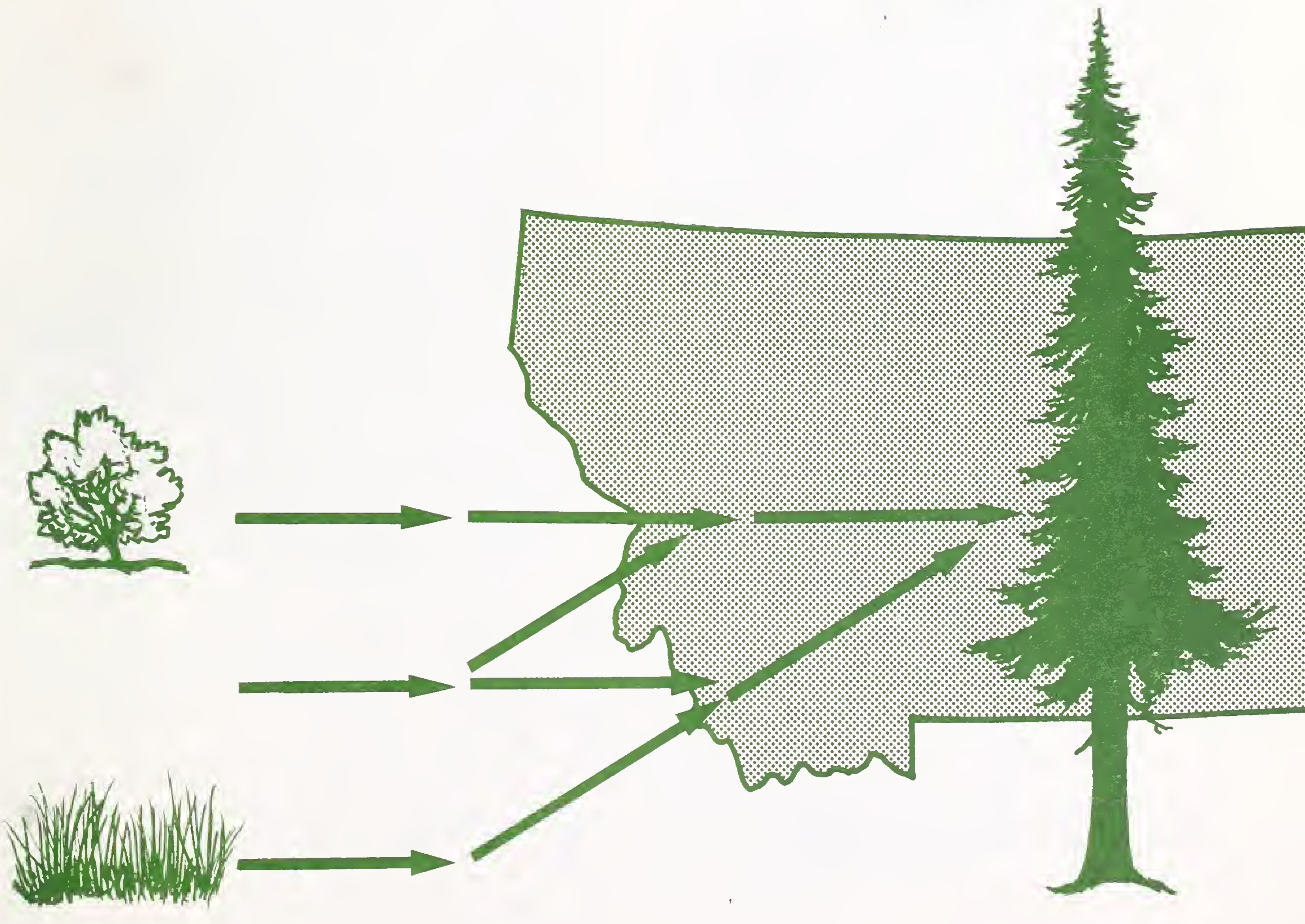
Forest Succession on Four Habitat Types in Western Montana

**Stephen F. Arno
Dennis G. Simmerman
Robert E. Keane**

U.S.D.A.
NAT'L AGRIC LIBRARY
RECEIVED

APR 24 '85

PROCUREMENT SECTION
CURRENT SERIAL RECORDS



841364

THE AUTHORS

STEPHEN F. ARNO is a research forester in the Prescribed Fire and Fire Effects research work unit at the Northern Forest Fire Laboratory, Missoula, MT. He was a coauthor of the Montana forest habitat type classification (Pfister and others 1977) and has studied various aspects of forest ecology since joining the Forest Service in 1970.

DENNIS G. SIMMERMAN is a forester with the Prescribed Fire and Fire Effects research work unit located at the Northern Forest Fire Laboratory. Previously he worked with the Fire Technology research work unit. He earned a B.S. degree in forestry from the University of Arizona.

ROBERT E. KEANE conducted the field evaluation of the successional classification under a cooperative agreement between the Intermountain Forest and Range Experiment Station and the University of Montana. He is modeling the successional pathways using a computer as part of his M.S. degree program at the University's School of Forestry. He earned a B.S. degree from the University of Maine in forest engineering and later worked with ecological consulting firms.

ACKNOWLEDGMENTS

Robert Pfister (director of the Mission-Oriented Research Program at the University of Montana's forestry school) provided encouragement and valuable advice for developing and carrying out this study. Many others have also provided detailed suggestions that have led to improvement in this work. These include James K. Brown, Project Leader, Northern Forest Fire Laboratory, Missoula, MT; James R. Habeck, professor, Botany Department, University of Montana; Robert Steele and Russell A. Ryker, research foresters, Forestry Sciences Laboratory, Boise, ID; Stephen V. Cooper, forest ecologist, Forestry Sciences Laboratory, Missoula, MT; Kenneth Neiman, forest ecologist, Forestry Sciences Laboratory, Moscow, ID; David M. Ondov, forester, now located on the Flathead National Forest, Bigfork, MT; Hans Zuuring, University of Montana, School of Forestry, who served as Robert Keane's faculty advisor; and Norman L. Christensen, associate professor of botany and forest ecology at Duke University. We also received encouragement and help from numerous people on the National Forests in the Northern Region and from Robert Naumann and Wendel Hann at the Regional Office.

RESEARCH SUMMARY

This paper presents classifications of successional community types arising after clearcutting and fire treatments on four major forest habitat types in western Montana. A total of seven classifications were developed based upon data from 770 sample stands. Each classification represents sequences of seral community types found on sites capable of supporting a "potential vegetation type," similar to a habitat type phase. The classifications were based on analysis of data from treated (ages 4 to 80 years) and untreated stands on the four habitat types. Treated communities arose after stand-replacing wildfire and after clearcutting with broadcast burning, mechanical scarification, or no followup site or slash treatment. Paired treated and untreated stands located immediately adjacent to each other on the same site were chosen as the basis for the initial classification, which was later field tested and refined based on new data from a wide range of seral communities.

Within a given potential vegetation type, the highest level in the successional classification hierarchy is the structural stage. There are five stages: shrub-herb, sapling, pole, mature seral forest, and old-growth forest. The structural stage is determined using values of the following stand characteristics: tree canopy coverage (percent), diameter (d.b.h.) of dominant trees, basal area of trees, and stand age. Community types are then designated based upon the composition of undergrowth and overstory species. Probable pathways of succession or stand development are shown as arrows linking community types in the classification diagrams. In order to provide insight for vegetation management, the classifications also list the treatments and site or stand conditions associated with each posttreatment community type.

Simple diagnostic keys are provided for determining which of the seven successional classification diagrams is appropriate for use on a given stand and for identifying the successional community type. A brief description accompanies each classification and gives a synopsis of the successional patterns identified in the undergrowth and tree layers in relation to kind and intensity of treatment. This includes interpretations of natural and planted tree regeneration. Response of each major undergrowth species to various treatments across a range of habitat types is also summarized.

CONTENTS

FIGURES

TABLES

Forest Succession on Four Habitat Types in Western Montana

Stephen F. Arno
Dennis G. Simmerman
Robert E. Keane

INTRODUCTION

Reasons for Study

The publication "Forest Habitat Types of Montana" (Pfister and others 1977) describes a system for classifying forest lands into "habitat types" based upon potential or "projected" climax vegetation. Because the system is based on the mature forest vegetation associated with a habitat type, the publication offers only occasional inferences as to the development of seral communities within habitat types. Nevertheless, the habitat type classification has stimulated an interest in successional patterns within habitat types and has also provided a logical framework for studying forest succession.

The need for understanding succession within each habitat type is heightened by the fact that, because of fire and logging, early to mid-seral community types have been and will continue to be a major component of the forest landscape. Moreover, different silvicultural practices allow land managers to develop markedly different successional communities on a given habitat type or even on a single site. The differences in seral communities are of great importance for timber production, forest protection (from wildfire, insects, and pathogens), wildlife, range, watershed, recreation, and for natural area values.

This study was initiated in 1977 in order to develop classifications of seral communities on a few major habitat types in western Montana. Field sampling was carried out during four summers (1977-80), and then a review draft classification was made available in 1982 and intensively tested in the field during 1983. New data and refinements resulting from the field test have been incorporated here. These classifications and the accompanying information can be used by land managers and researchers as an aid in predicting successional development of forest communities (and treatment response) in relation to various types of cutting and fire treatments.

A comparatively brief description of methods is given here; however, a detailed treatment, including recommended procedures for developing similar classifications in other habitat types or regions, is being prepared by the same authors. (The proposed outlet is **Forest Science.**)

Objectives

The major objectives of this study were: (1) to develop a general-purpose classification of the seral community types on selected habitat types; (2) to outline or model the successional sequences of community types on each habitat type; and (3) to document changes in canopy coverage by species during each successional sequence.

Secondary objectives were to interpret establishment and early growth of tree regeneration and development of undergrowth in relation to treatment and site characteristics.

Scope

This study was initiated as an attempt to classify the successional pathways that result from stand-replacing wildfire and clearcutting within selected habitat types, based on field sampling. A rather limited geographic area was chosen for study in order to minimize variation caused by regional differences in vegetation. The investigation was focused on four major forest habitat types that often lie adjacent to each other on the mountainous landscape of west-central Montana (fig. 1). This allows for comparison of succession on a group of different but related environments. According to the Lolo National Forest's detailed habitat type map, about 55 percent of the forest is occupied by these four habitat types.

Successional data were compiled for common stand-removing treatments: stand-replacing wildfire (WF); clearcutting without site preparation or slash treatment (NP); clearcutting followed by broadcast burning (BB); and clearcutting with mechanical scarification, usually dozer piling and burning (MS).

STUDY AREA

The study was concentrated on the Lolo and Bitterroot National Forests, the southern portion of the Flathead National Forest, and the Flathead Indian Reservation. This area is composed of rugged, heavily forested mountains separated by a few large grassland/agricultural valleys. Elevations range from about 3,000 ft (915 m) in the major valleys to 7,000 ft (2 135 m) or higher on the mountain ridges. Most of the land above 7,000 ft is in the slow-growing "upper subalpine forest" described by Pfister and others (1977).

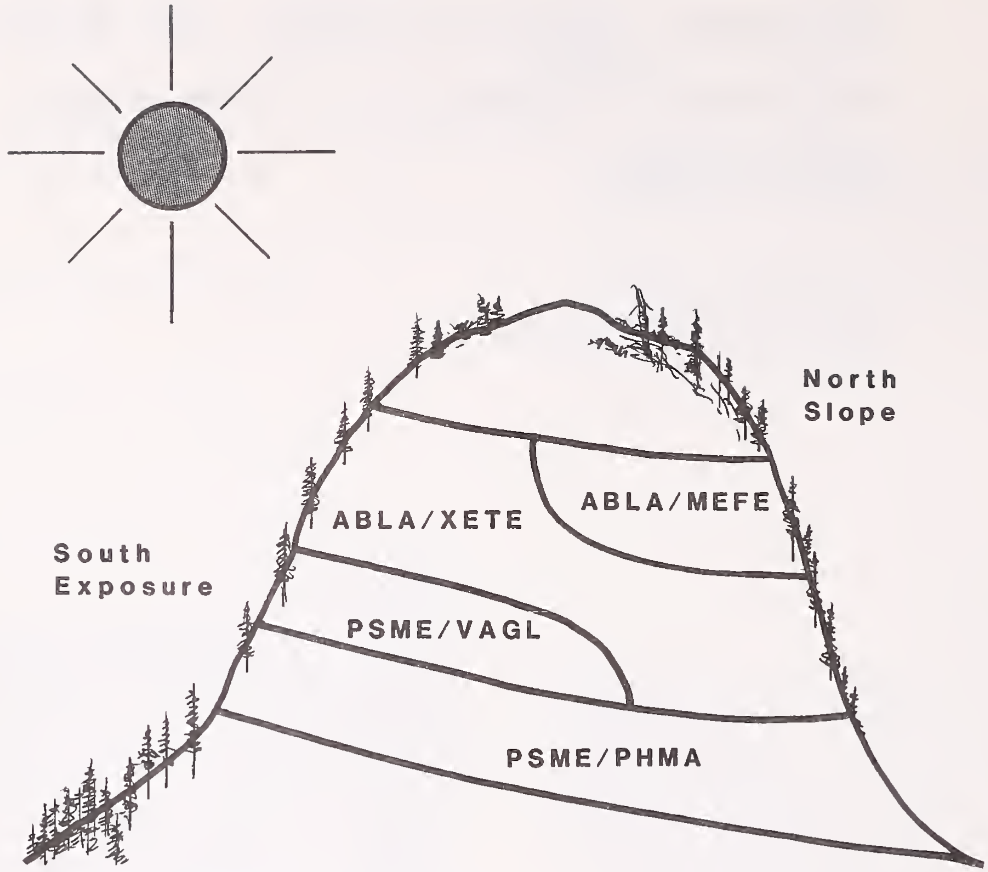


Figure 1.—Schematic distribution of some major forest habitat types in west-central Montana.

ABLA = Abies lasiocarpa	*PHMA* = Physocarpus malvaceus
PSME = Pseudotsuga menziesii	*VAGL* = Vaccinium globulare
MEFE = Menziesia ferruginea	*XETE* = Xerophyllum tenax

The surface geologic formation in the northern two-thirds of the study area is the Precambrian Belt Series, consisting primarily of quartzites and argillites. The southern third, largely in the Bitterroot National Forest, is mostly of granitic origin. In general, the forest soils are of medium to coarse texture and are shallow and rocky, reflecting the steep mountainous setting. Soil mantles on leeward slopes (generally facing north and east) are deeper than those on windward slopes, because of ancient wind-transported deposits of volcanic ash and loess.

Study sites apparently have three major subgroups of soils as described in the Soil Conservation Service (1975) classification: Cryoborolls on the warmest and driest sites; Cryandepts on sites having volcanic ash deposits; and Cryochrepts on most other sites. According to Nimlos (1963), most soils in these forests have a B_{ir} horizon 4 to 18 inches thick.

The climate of this portion of western Montana can be described as inland maritime. It is characterized by a cold, snowy winter; a cool, rainy spring; a short, warm-dry summer; and a cool-dry autumn. Mean annual precipitation ranges from about 15 inches (38 cm) in the drier *Pseudotsuga menziesii/Physocarpus malvaceus* (PSME/PHMA) sites to about 40 inches (102 cm) in the *Abies lasiocarpa/Menziesia ferruginea* (ABLA/MEFE) habitat type. Topography has a major influence on climate in this area. With increasing elevation, precipitation generally increases, while temperature decreases. North and east exposures are relatively cool and moist because of decreased insolation and better soil development and moisture retention. Conversely, steep south and west exposures tend to be warm and dry.

FIELD METHODS

Sampling Approach

In order to build a successional classification for a given habitat type, it was necessary to obtain data from stands representing different ages since treatment. It was judged unfeasible, however, to simply piece together a chronologic sequence of different stands arising after a given kind of treatment. Numerous attempts by others have shown that three major uncontrolled variables confound such an approach: (1) site variability within a habitat type; (2) geographic variations in vegetation; and (3) differences in stand history prior to treatment.

These sources of variation could be minimized by sampling an untreated or "control" stand immediately adjacent to each treated community (Zamora 1975). Field reconnaissance revealed that it was possible to locate one or more young communities (arising from fire or logging) as well as a remnant of the original stand, growing side by side on the same site with similar topography

and soils (fig. 2). Thus, the approach of sampling multiple stands on the same site was chosen as the basis for this study. It was possible to locate stands in each habitat type, ranging in age from 1 to 200 or more years since burning in a stand-replacing wildfire. Stands ranging up to about 30 years of age were available for the clearcutting treatments.

Long-term sampling of permanent plots on an annual basis would provide the most reliable data for constructing a classification of seral communities. For each habitat type and treatment, however, numerous plots would have to be established before treatment, and recorded for 100 years or more to cover only the early and middle stages of succession. Fortunately, Stickney (1980, in prep.) and Lyon and Stickney (1976) have begun this process and have provided detailed records of early successional changes after wildfires and broadcast burns on a few sites in the four habitat types. Because of the availability of these detailed early successional data—and to avoid the additional complexity of dealing with short-lived, early seral herbaceous plants that may initially become dominant—we concentrated sampling on communities 4 years or older since treatment.

Stand Selection

Using information from local foresters, we attempted to find stands representing a range of ages since treatment for each kind of treatment in each habitat type. We made reconnaissance trips to locate potential multiple sample stands (treated and untreated) on the same site. Potential sample stands were evaluated on apparent uniformity of treatment and adequate size for sampling. Multiple stands on what appeared to be the same site were then chosen for sampling based on reconnaissance evaluations. We attempted to obtain a good geographic dispersion of sample stands within the study area. Also, we sought to obtain a range of treatments and ages. Sites that had adjacent stands representing two or more treatments, and an untreated stand, were favored for sampling because of the extra information they would provide for comparisons.

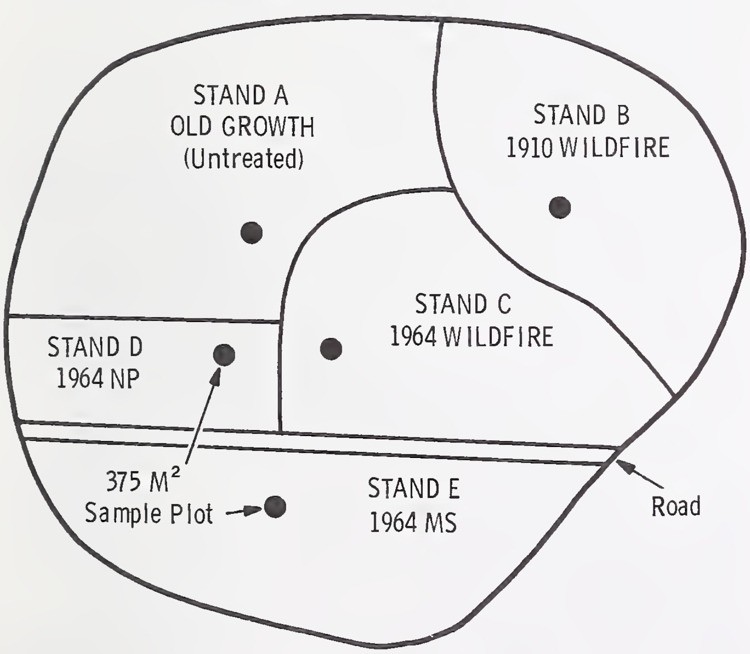


Figure 2.—Example of multiple stands having different treatments occurring on one site with similar soils and topography throughout. (NP = clearcut with no site or slash treatment; MS = clearcut and mechanically scarified.)

Sampling Procedures

Within all stands chosen for sampling, we assessed the variation in tree and undergrowth composition and in intensity of treatment. This assured that our nearly 1/10-acre (375-m^2) circular plot would be located in a representative area of the community. The plot size, location, and sampling procedures are similar to those employed in the Montana forest habitat type classification (Pfister and others 1977). Plot location procedure is described as "subjective without preconceived bias" by Mueller-Dombois and Ellenberg (1974), and is explained by Pfister and Arno (1980).

Scarified stands (dozer-pile and burn) are intricate mosaics of scraped areas, heavily burned areas, and areas that essentially escaped site treatment. On mechanically scarified stands, we set up a macroplot that included representative proportions of the treatment mosaic. It would have been informative to have sampled large numbers of small plots in each treated stand in order to document the microvariation; however, it would have necessitated a large effort to amass statistically based data of this sort. We chose to invest our limited resources on characterizing community types, rather than sampling mosaics within the communities.

Canopy-coverage data for all herbaceous and woody plants, including trees, were recorded as described by Pfister and Arno (1980), with each species' coverage being visually estimated within the entire macroplot. Coverage classes were recorded as follows: + = present in the stand, but not in the plot; T = less than 1 percent canopy coverage; 1 = 1-5 percent; 2 = 5-25 percent; 3 = 25-50 percent; 4 = 50-75 percent; 5 = 75-95 percent; 6 = 95-100 percent. Further, the numbered classes were split into a lower, middle, and upper range—for example, 2−, 2, and 2+—for additional refinement. (In retrospect, it would have been simpler to estimate coverages in 10 percent or 20 percent classes except for those under 5 percent.) To help enhance comparability of data, one investigator (Arno) was responsible for rating coverages of all species in all sample plots.

All trees were tallied by species and 2-inch diameter size classes. Stand history was determined through analysis of increment cores or cross-sections (taken near ground level) from trees regenerating after the disturbance and cross-sections from residual trees showing growth release or scars dating from disturbance (Arno and Sneck 1977). Records of site treatments were also obtained from district foresters.

Measurements of average depth of litter, fermentation, and humus layers on treated stands, in comparison to their untreated counterparts, indicated the relative intensity of treatment as did the percentage of exposed mineral soil. In clearcut broadcast-burned stands the completeness of combustion of various size classes of slash was observed. Texture of the mineral soil and the type of soil parent material were recorded in each stand.

Evidence of natural and planted tree regeneration was noted on treated sites and was also gleaned from management records. Stocking of established regeneration was estimated in three classes:

1. **Adequate** regeneration - more than 250 trees per acre and well distributed
2. **Inadequate** - between 100 and 250 per acre, or poorly distributed
3. **Nonstocked** - less than 100 per acre

Heights and total ages (from increment borings near ground level) were obtained for vigorous, free-growing, dominant trees of each species, as available. This information was used to calculate 50-year site indexes, as was done by Pfister and others (1977), and to represent timber productivity of young seral communities.

DEVELOPING THE CLASSIFICATION

Original Data Base

A total of 386 stands occupying 144 sites were sampled on the four habitat types; 242 stands had been treated, while the remaining 144 were untreated, mature stands including seven 100-year-old wildfire stands. The treated stands are divided as follows:

1. Stand-replacing wildfire, 79 stands (including the seven, 100-year-old stands also listed in the untreated category)
2. Clearcutting with broadcast burning, 46
3. Clearcutting with mechanical scarification, 68
4. Clearcutting with no site or slash preparation, 48
5. Other treatments (terracing), 8

Postclearcut sample stands generally ranged in age from 4 to 25 years in all habitat types; whereas postwildfire stands were from 5 to 100 years old, with the majority over 50 years. Data from all sample stands were coded for computer-assisted analyses, which were carried out during each of the four winters on the newly compiled data and on the entire data set. Thus, the analyses (described later) were run repeatedly, with the help of different technicians, which allowed for repeated evaluations and refinements.

Verification and Refinement with Additional Data

A review draft of the classifications was distributed for field use by foresters and other land management specialists in May 1982. During the summer of 1983 the classifications were field tested as part of a cooperative study between the Intermountain Forest and Range Experiment Station and the University of Montana (Keane 1983). The classifications were applied in a total of 392 young seral communities located throughout the study area in four habitat types. These communities had resulted from wildfire and clearcutting with broadcast burning, mechanical scarification, and no site preparation. Unlike the original sampling, these stands were not required to be located adjacent to an untreated "control" stand. District foresters were also invited to independently apply the classifications to some of the same young communities. This resulted in a total of 73 seral stand evaluations made by 16 field personnel.

This evaluation (Keane 1983) showed that the classifications and keys fit well or satisfactorily in most sample stands, but pointed out numerous opportunities to refine the keys and presentation of the classifications. Keane (1983) also collected coverage class data for undergrowth and tree species at each test stand, and these data were pooled with those from the original study stands, greatly expanding the data base for classifications. Synthesis tables displaying data from all stands (770 in total, since eight from the Idaho side of the Bitterroot Range divide were not used in the final classification) were jointly interpreted by the three authors as the basis for refinements made since the 1982 review draft.

Defining Potential Vegetation Categories

The first step in constructing the classification was to evaluate the variation within each habitat type using data from all mature stands. The purpose of this was to judge whether the habitat types and phases of Pfister and others (1977) would provide a suitable environmental stratification for the successional classification. Three data banks were examined separately for major variations in potential vegetation within them (initial inspection revealed that potential vegetation differed greatly between these data banks):

1. PSME/PHMA h.t., 50 sites
2. PSME/VAGL and ABLA/XETE h.t.'s, 56 sites
3. ABLA/MEFE h.t., 38 sites

Index-of-similarity ordinations (Bray-Curtis polar ordinations as outlined in Pfister and Arno 1980) were constructed, based upon all the untreated stands in each data bank. This was done to detect differences in potential vegetation within a habitat type that may reflect substantial differences in sites. Synthesis or association tables were also used for a similar purpose (Mueller-Dombois and Ellenberg 1974; Pfister and Arno 1980). We looked for consistent differences, within each data bank, in the presence and canopy coverage of individual species and groups of species (herbs, shrubs, and trees). The goal was to evaluate differences in potential vegetation (the end point of succession) to be used as a basis for classification. In addition to examining untreated stands, we also inspected the data from younger communities to see if their vegetation seemed to reflect site-related differences.

The result of this investigation of potential vegetation categories is shown in figure 3, which compares the "potential vegetation types" used in this classification with Pfister and others' (1977) habitat types. Overall,

	Montana Forest Habitat Types (Pfister and others 1977)	"Potential Vegetation Types" for Successional Classification
Warm and dry sites	PSME/PHMA h.t., CARU phase	PSME/PHMA, dry phase (LAOC poorly represented)
	PSME/PHMA h.t., PHMA phase	PSME/PHMA, moist phase (LAOC well represented)
	PSME/VAGL h.t., XETE phase	PSME/VAGL, XETE phase Sites with ABLA poorly represented
	ABLA/XETE h.t., VAGL phase	ABLA/XETE, VAGL phase
	ABLA/XETE h.t., VASC phase	ABLA/XETE, VASC phase
Cold and moist sites	ABLA/MEFE h.t.	ABLA/MEFE, warm phase (PSME or LAOC common)
		ABLA/MEFE, cold phase (PSME and LAOC scarce)

Figure 3.—Schematic representation of the relationship, along a gradient of environmental change, of our seven potential vegetation types to the habitat types of Pfister and others (1977).

the Pfister and others' habitat types seem quite suitable as a basis for our successional classifications, but we found it necessary to make some modifications, mostly at the phase level. These modifications are a result of a detailed inspection of a few habitat types in a limited area of Montana; thus, they may not be appropriate for application beyond this study.

Our seven potential vegetation types (fig. 3) can be described as follows: We have split the broad PSME/PHMA h.t. of western Montana into a dry and a moist phase, based upon the ability of these sites to support appreciable amounts ("well represented"—>5 percent canopy coverage) of western larch (*Larix occidentalis*). Several dry-site (for example, bunchgrass species) and moist-site plants (examples, *Linnaea borealis*, *Lonicera utahensis*, and *Pinus contorta*) also reflect the substantial variation in moisture across this habitat type. In our data, however, western larch was clearly the most ubiquitous indicator of relatively moist sites.

This phase split seems easier to apply than the one in Pfister and others (1977) and has direct application to succession, since western larch is a major overstory component only in the moist phase. Daubenmire (1973) made a similar environmental split, based upon western larch, within PSME/PHMA on the Priest River Experimental Forest in northern Idaho. We recognize the theoretical drawback of defining a phase on a successional tree species (western larch here, and larch and Douglas-fir, *Pseudotsuga menziesii*, in our ABLA/MEFE warm phase); however, these trees are very long-lived (>300 years) in most stands, and the frequency of disturbance has been sufficient to allow these species to perpetuate themselves in the vast majority of sites that seem climatically favorable for them. The dry phase of the PSME/PHMA seems to be more abundant in west-central Montana than the moist phase.

The southern portion of the Bitterroot National Forest lies beyond the geographic distribution of western larch, and thus has no PSME/PHMA moist phase as defined here. This southern portion is climatically drier than most of the study area and has less PSME/PHMA h.t. overall. It is possible that limited areas of PSME/PHMA moist phase conditions exist here, undetected in our sampling, and that they could be identified by the presence of *Linnaea borealis* or other moist-site species.

We have incorporated the warmest driest ABLA/XETE h.t. VAGL phase sites (Pfister and others 1977), along with the PSME/VAGL h.t., in our PSME/VAGL, XETE phase potential vegetation type. Stands on these sites (fig. 3) seem very similar successionally to other PSME/VAGL stands except for the addition of small amounts ("poorly represented"—<5 percent canopy coverage) of subalpine fir (*Abies lasiocarpa*), which does not become a major component even in old-growth stands.

Because of the above alteration, our ABLA/XETE, VAGL phase potential vegetation type includes slightly less environmental variation than the h.t. phase, while our PSME/VAGL, XETE phase potential vegetation type is broader than the h.t. phase itself. We have used Pfister and others' (1977) VASC phase without modification.

Pfister and others did not recognize phases within the ABLA/MEFE h.t.; however, we feel it necessary to define a warm and a cold phase. Douglas-fir or western larch are "common" (>1 percent canopy coverage) in the

warm phase and *Vaccinium scoparium* is "scarce" (<1 percent). The opposite is true of the cold phase, which is comparatively poor in overstory and undergrowth species. Much of our study area is at the geographic limits of the ABLA/CLUN h.t. on upland slopes, and it appears that our ABLA/MEFE warm phase is to some extent a geographical replacement for the ABLA/CLUN h.t., MEFE phase of northwestern Montana and northern Idaho.

After defining the seven potential vegetation types shown in figure 3, we set about constructing an individual successional classification for each one.

Classification Framework

STRUCTURAL STAGES

Upon inspection of successional patterns shown in the data for each of the seven potential vegetation types, it became apparent that the classification would have to deal with both changes in stand structure and species composition. The most promising approach for the highest level in the classification hierarchy seemed to be delineating simple structural or developmental stages, such as those used by Thomas (1979). Then, major differences in composition could be recognized within the appropriate structural stage.

In order to define a framework of structural stages, the following parameters from each sample stand were inspected for logical groupings: total percentage of canopy coverage by trees; d.b.h. of dominant trees; basal area per acre of tree stems; and years since treatment. This grouping process made it apparent that succession in each of the habitat type phases could be divided into five structural stages: (1) shrub-herb, (2) sapling, (3) pole, (4) mature seral forest, and (5) old-growth forest. The last stage includes both "near-climax" and "climax" forest conditions; the latter was seldom found in any of the four habitat types investigated in our study area. This structural stage classification is illustrated along the horizontal axis of figure 4. The lower part of figure 4 shows the range of values associated with each structural stage for tree canopy coverage and the other stand characteristics. The shrub-herb stage includes tree seedlings, but usually the young trees do not develop sufficient canopy coverage to warrant calling this a shrub-herb-seedling stage. Exceptions to this include the dense PICO seedling community types designated in the PSME/VAGL and ABLA/XETE potential vegetation types.

COMPOSITIONAL COMMUNITY TYPES

After segregating all stands associated with a potential vegetation type into the structural stages, the next step was to differentiate seral community types based upon characteristic tree and undergrowth species. Community types are listed vertically below the structural stages (fig. 4). The shade-tolerant undergrowth species (VAGL in fig. 4), are characteristic of pole stage and older communities. Under certain conditions, however, they are also major components of the younger stages. Other species, such as CARU and CEVE in figure 4, become the characteristic components only in younger communities.

We used synthesis tables, index-of-similarity ordinations, and cluster analyses (listed in order of decreasing usefulness) to aid in finding compositional groupings of stands in the shrub-herb and sapling stages. The approach was similar to that recommended by Pfister and Arno (1980). A certain amount of judgment based upon field sampling experience with these stands was also applied in the process of designating community types. Because of the limited number of sample stands in each stage, the rather small study area, and the lack of other classifications with which to compare, we have tended to recognize only the more obvious community types. Further sampling within our area, or expansion to other nearby areas, might well reveal community types that we have overlooked. We tended to designate community types based on major components of the undergrowth or the overstory. Also, we recognized either individual species or groups of ecologically similar species that showed rather consistent successional relationships. Finally, we developed simple stepwise keys for identifying community types within a potential vegetation type.

SUCCESSIONAL PATHWAYS

After the apparent community types had been differentiated, we attempted to define the usual pathways of succession or stand development. These successional pathways (shown as arrows on fig. 4) were discerned through analysis of data from sample stands of different ages on the same site. Also, trends in canopy coverage of successional species were identified and used as evidence for denoting pathways. For instance, coverages of fireweed (*Epilobium angustifolium*) and young conifers were inversely related. In contrast, huckleberry (*Vaccinium globulare*) tends to expand beneath the newly developing tree layer in a sapling stand. The process of identifying probable successional pathways based on stand data and knowledge of ecological relationships gave us insight for evaluating and refining some of our initial community type categories.

Interpreting Response to Treatment

RELATING TREATMENT TO COMMUNITY TYPE

After developing the successional classification associated with each potential vegetation type based on sample stand data, we attempted to link the kind and intensity of treatment to the initial (posttreatment) community type. Our information on treatment was based on field inspection and the available management records. Intensity of treatment could be rated in general, qualitative categories based upon the thickness of the surface organic layers, percentage of bare mineral soil exposed, and evidence of fine- or medium-sized woody fuels remaining after fire. Evaluations of treatment intensity had to be tempered by considering the amount of time and vegetal development since treatment.

We inspected the stand data to determine which kinds and intensities of treatment were associated with a given posttreatment community type (shrub-herb and sapling stages). Linkages to treatment were often unclear, but could be improved by also keeping track of the composition of untreated vegetation on the site and severeness

STRUCTURAL STAGES						
Community types	Row No.	SHRUB-HERB	SAPLING	POLE	MATURE SERAL FOREST	OLD GROWTH FOREST
	1	VAGL	PSME/VAGL	PSME/VAGL	PSME/VAGL	PSME/VAGL
	2	CARU	PICO/CARU	PICO-PSME/CARU		
	3	CEVE	PICO/CEVE			

STAND CHARACTERISTICS					
Tree canopy cover (percent)	0-15	15-90	50-90	50-80	50-70
d.b.h. of dominant trees (inches)	0-1	2-5	6-10	11-15	16-25
Basal area (ft^2/acre)	0-1	2-100	100-250	100-250	150-250
Age (yr)	5-15	15-30	30-100	100-200	200-300

Figure 4.—Simplified classification for the purpose of illustration only.

of exposure and coarseness of soils. As a result of this data inspection, each successional classification has a box at the left showing treatments, pretreatment vegetation, or site conditions associated with early seral community types (example, fig. 5, page 11). These are general trends from our data.

SPECIES RESPONSE TO TREATMENT

In addition to providing a basis for classification of seral community types, the data from multiple stands on the same site allowed us to evaluate the response of each species to each kind of treatment within each potential vegetation type. In order to do this we set up tables that allowed for comparison of canopy coverages by species in paired (untreated vs. treated) stands. We used quantitative criteria (description on file at the Northern Forest Fire Laboratory, Missoula, MT), for rating the response of species to a given treatment. A brief interpretation of the response of each species is provided in the Species Response section of this report.

TREE REGENERATION RESPONSE

Tree regeneration data were taken as a small, auxiliary part of the study. The reconnaissance basis (rather than a statistical basis) of our field sampling and the emphasis on representing the entire plant community limited our ability to provide a detailed analysis of tree regeneration in relation to the successional classification. Nevertheless, some of the relationships of natural and planted regeneration to treatment by habitat type phases seem dramatic and can be interpreted at a low level of resolution from our data. Interpretations of tree regeneration are given in the narrative description of succession associated with each potential vegetation type. Fiedler (1982) also analyzed the regeneration data from our sample stands and drew conclusions on the relationship of regeneration success to habitat type, slope steepness and aspect, and treatment.

Keep in mind that our interpretations of planting success are based on results of widespread plantings done between the early 1960's and the mid-1970's. Artificial regeneration technology and field practices have improved substantially since then. Still, our observations indicate the relative ease or difficulty of obtaining artificial regeneration on the different phases and community types.

Identifying the Potential Vegetation Type of a Seral Stand

After major disturbances such as clearcutting or wildfire, it may be difficult to determine the appropriate habitat type on a site. The following guidelines are offered for such habitat type identification:

1. Apply the habitat type keys from Pfister and others (1977) to the least disturbed portions of the stand or to an adjacent stand on a similar topographic site that appears to represent a more mature stage on the same habitat type.
2. If the entire site is severely disturbed, perhaps a similar site with less disturbed vegetation can be found on the next ridge or valley.
3. Residual "islands" of pretreatment vegetation can often be found in logging units, and the prelogging or prefire tree community can usually be reconstructed by identifying the species and sizes of stumps (bark on old stumps is particularly helpful).
4. Habitat type maps are available for much of the national forest and Flathead Reservation lands; these can be used with caution for estimating habitat type when field evidence is poor.
5. If *Physocarpus malvaceus* is common and grand fir is not the indicated climax, the PSME/PHMA h.t. is likely. If *Menziesia ferruginea* is common (in the least disturbed areas) and *Clintonia uniflora* is scarce or absent, the ABLA/MEFE h.t. is likely.
6. Determine habitat type and phase using the Pfister and others keys and then use the key below to help identify the appropriate successional classification:

H.t. and phase (Pfister and others 1977)	Additional criteria	Potential vegetation type key (and page no.)
PSME/PHMA, CARU		PSME/PHMA, dry phase, p. 10
PSME/PHMA, PHMA	LAOC <5% canopy coverage (C.C.)	PSME/PHMA, dry phase, p. 10
	LAOC >5% C.C	PSME/PHMA, moist phase, p. 14
PSME/VAGL, XETE		PSME/VAGL, XETE, p. 18
ABLA/XETE, VAGL	ABLA <5%[1] C.C.	PSME/VAGL, XETE, p. 18
	ABLA >5% C.C.	ABLA/XETE, VAGL, p. 22
ABLA/XETE, VASC		ABLA/XETE, VASC, p. 26
ABLA/MEFE	PSME or LAOC>1% C.C.	ABLA/MEFE, warm phase, p. 30
	PSME and LAOC <1% C.C.	ABLA/MEFE, cold phase, p. 34

[1]This split may sometimes work better at the 25 percent level.

SUCCESSIONAL CLASSIFICATIONS BY POTENTIAL VEGETATION TYPE

1. *Pseudotsuga menziesii/Physocarpus malvaceus* (PSME/PHMA), Dry Phase

Site characteristics.—This phase is widespread and abundant in western Montana. It is usually associated with moderate to steep south- or west-facing slopes, but in relatively dry areas it occupies north or east aspects. Our sample stands were located between 3,200 and 5,800 ft (975 and 1 770 m) in elevation.

Mean site-index values for vigorous young dominant trees and mean maximum heights of old-growth trees on sample sites are shown in appendix C. These are compared with values derived by Pfister and others (1977) for the comparable habitat types in western Montana. Our field and office methods for determining site indexes are essentially the same as those of Pfister and others (see their p. 127-131). Our site-index and maximum-height values for the dry phase appear to be lower than those of Pfister and others for the habitat type as a whole.

Successional classification.—The following key to the successional classification for the PSME/PHMA dry phase (fig. 5) should be used to determine the appropriate community type for an unclassified stand.

KEY TO SUCCESSIONAL COMMUNITY TYPES WITHIN THE PSME/PHMA, DRY PHASE

Dry phase sites are those where western larch is "poorly represented" (<5 percent canopy coverage) in stands of all ages, as indicated on page 9.

1. Select the most appropriate **community type row number** for the stand in question through use of the undergrowth key below (first priority). Then compare the tree species composition (second priority) with the community type names for that row in figure 5.

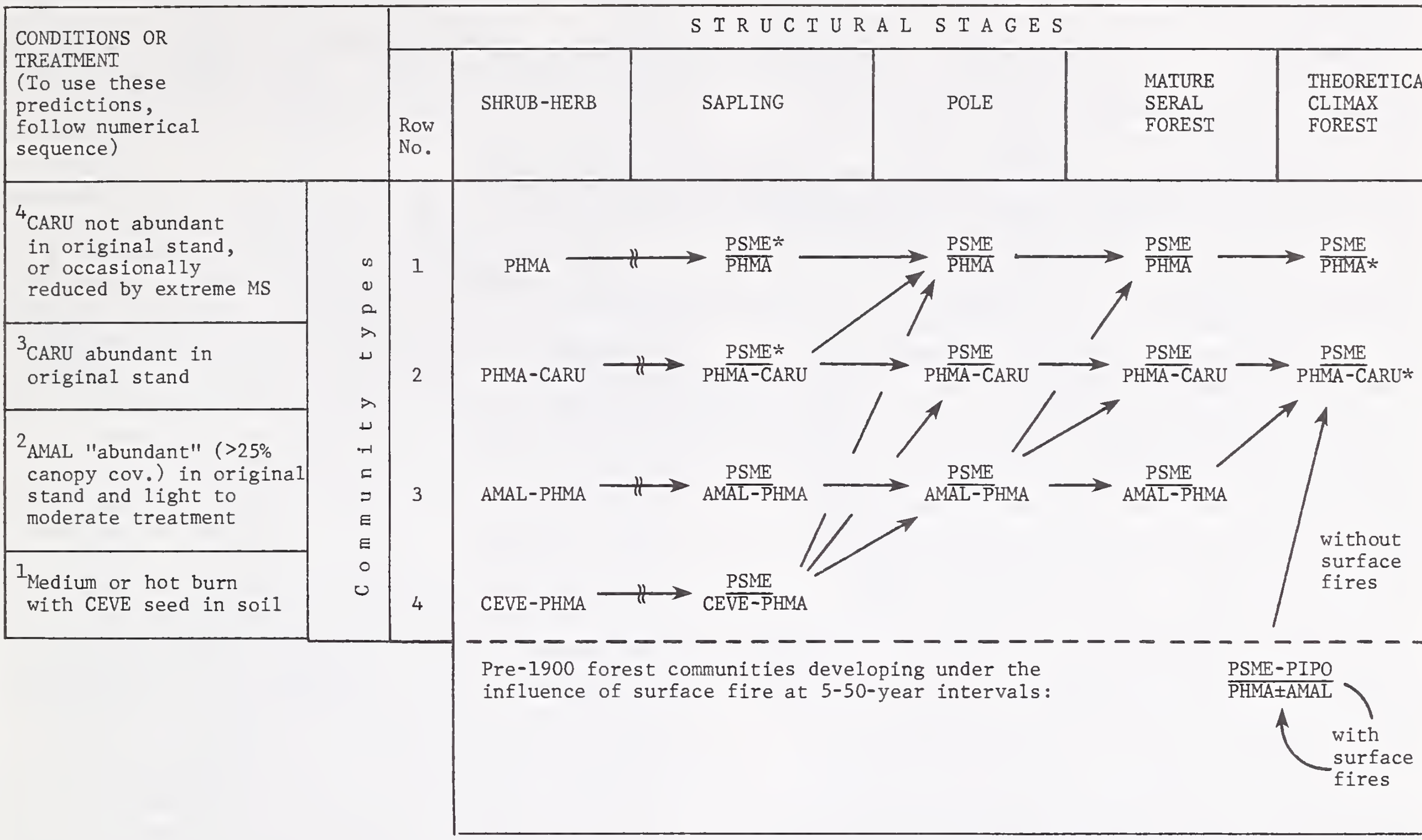
Stop at the first requirement that fits:[2]	COMMUNITY TYPE ROW NUMBER (in fig. 5)
a. *Ceanothus velutinus* >5% canopy coverage (C.C.)	4
b. *Amelanchier alnifolia* or *Acer glabrum* or *Salix scouleriana* or their combined coverages >15%	3
c. *Calamagrostis rubescens* or *Carex geyeri* or their combined coverages >25%	2
d. None of above; *Physocarpus malvaceus* >5% C.C.	1

2. Select the most appropriate structural stage for the stand by comparing it with the stand characteristic values listed in figure 5 for tree canopy coverage, average d.b.h. of dominant trees, stand basal area, and stand age.

3. Inspect appendix A-1, which shows constancy and average canopy coverages of different species in each community type. Is the stand in question compositionally similar to sample stands shown in the indicated community type? If so, it apparently "fits" that community type. If it is dissimilar in terms of major component species, compare it with the other community types listed. It may fit one of those types, or it may not fit this classification at all, which was true of two of the 148 stands (1.4 percent) we sampled.

---

[2]In stands where undergrowth is obviously depauperate (unusually sparse) because of dense shading or duff accumulations, coverage requirements for the climax species (in this case, community type rows 1 and 2) can be reduced.



Stand Characteristics by Structural Stage
(Range represents about 90% of the data; extreme values are shown in parentheses)

		SHRUB-HERB	SAPLING	POLE	MATURE SERAL FOREST	THEORETICAL CLIMAX FOREST
Range of values from sample stands	Tree canopy coverage percent	0 - 15	15 - 60(90)	45 - 85	(30)40 - 75	
	Average d.b.h. of dominant trees (inches)	0 - 2	2 - 6	6 - 14	12 - 24	
	Basal area (ft^2/acre)	0 - 6	5 - 60(133)	70 - 200	100 - 260	
	Stand age (yr)	3 - 30	13 - 50	50 - 85	100 - 300 +	
Number of sample stands		63	27	23	33	

TREATMENT CODES:
- BB = Clearcut with broadcast burn
- MS = Clearcut with mechanical scarification (dozerpile and burn)
- WF = Stand replacing wildfire
- ≀≀ = Establishment of natural tree regeneration delayed ≥ 20 years
- ± = with or without

TREES:
- PSME = *Pseudotsuga menziesii*
- PIPO = *Pinus ponderosa*

UNDERGROWTH:
- CEVE = *Ceanothus velutinus*
- PHMA = *Physocarpus malvaceus*
- AMAL = *Amelanchier alnifolia* (alternate indicators for AMAL are *Acer glabrum* and *Salix scouleriana*)
- CARU = *Calamagrostis rubescens* (alternate indicator for CARU is *Carex geyeri*)

Figure 5.—Successional community types (with natural tree regeneration) on the PSME/PHMA dry phase in western Montana. (Dry phase sites are defined as those where western larch is "poorly represented" in stands of all ages.) Constancy and coverage data for each community type are shown in appendix A-1. An asterisk indicates hypothesized community types without data. The box at left shows relationship of conditions and treatment to posttreatment community type, based on our data.

INTERPRETATIONS OF SUCCESSION

Undergrowth.—As figure 5 shows, we found that PHMA is essentially a permanent member of all successional sequences. Considering the principal codominant vegetation, however, we have identified three kinds of undergrowth ("unions") that persist in mature stands (fig. 5, rows 1-3). As indicated in the "condition or treatment" box in figure 5, the composition of pretreatment undergrowth largely masks the effects of treatment. The notable exception to this trend is the emergence of an early seral CEVE-PHMA community (row 4) after relatively hot fire treatments where CEVE seed persists in the soil. Unfortunately, it is a very laborious process to discover whether or not CEVE seed is present in the surface soil. A possible alternative would be to investigate the surrounding area thoroughly to see if CEVE plants are found in openings or disturbed sites (such as south-facing road cuts). If CEVE is present in the immediate vicinity on similar sites, it could be assumed that CEVE seeds occur in the soil. CEVE is highly intolerant of shade and dies out rapidly when young conifers begin to form a moderately dense canopy.

AMAL, ACGL, and SASC (fig. 5, row 3) are long-lived seral species in the dry phase that regenerate principally from root crown resprouting. Their coverage tends to increase in response to a BB or WF treatment and decrease in maturing stands, but often these tall shrubs have remained as a major component of the undergrowth even in mature stands. In mature stands, vigor and twig production has no doubt declined compared with early seral conditions.

PHMA-CARU (row 2) is the most prevalent undergrowth in mature stands, and, in the absence of CEVE seeds, the CARU or CAGE component is usually able to maintain or quickly regain dominance after burning or scarification treatments. The PHMA community type (row 1) was sampled in only two mature stands in Montana, while all four of the Salmon National Forest stands fit here. Responses of individual species by treatment type are discussed under Species Response.

Table 1 illustrates by specific examples that frequency of treatments and the pretreatment vegetation (Lyon and Stickney 1976) are important factors influencing the resulting vegetation. This table summarizes the treatment history and dominant vegetation on two PSME/PHMA dry phase sites where several different stands occur adjacent to each other. Stands 11D (that is "site 11, stand D") and 42C were burned more frequently than their neighbors, and as a result, seral shrub species like CEVE, SASC, and AMAL became dominant components. Conversely, stands 11B and 42D had gone so long without burning that recent wildfires did not result in an abundance of seral shrubs. In 42D, however, enough CEVE appeared to classify it CEVE-PHMA community type.

Cholewa and Johnson (1983) recently described succession in 27 communities in the *Pseudotsuga/Physocarpus* h.t. in northern Idaho; they represent succession as a continuum and do not offer a classification as such. Robert Steele (Intermountain Forest and Range Experiment Station, Boise, ID) has produced an unpublished classification of this habitat type in central Idaho using cone-shaped models for differentiating various tree, shrub, and herbaceous layer types; the approach is described in Steele (1984). Hann (1982) used a similar cone-model approach to classify seral community types on the *Pseudotsuga menziesii/ Linnaea borealis* h.t. in western Montana.

Trees.—Tree regeneration is difficult to obtain in the PSME/PHMA dry phase. Natural regeneration often required more than 20 years to become established. Planting (1960's to mid-1970's practices) was successful about half the time, and then mostly on terraced or scarified microsites. Natural regeneration that did occur was quite delayed and is predominantly Douglas-fir. In contrast, mature, untreated stands are composed of Douglas-fir and ponderosa pine, and about 80 percent of the >100-year-old stands show evidence of a history of underburning prior to about 1920. Occasional underburns evidently maintained mixed stands on most of these sites, as illustrated in figure 5, lower right. Our data for the PSME/PHMA and PSME/PHMA-CARU community types in the Mature Seral Forest stage (in appendix 5) represent vestiges of these conditions where PIPO has not yet passed out of the picture successionally although AMAL (and ACGL and SASC) may have been reduced in coverage as a result of >60 years of fire suppression. Although the pine is well adapted to most dry phase sites, it seldom regenerates adequately without planting after clearcutting or stand-replacing wildfire. Relatively frequent underburning generally favored dominance by ponderosa pine, while less frequent burning (with occasional severe fires) favored Douglas-fir. Hypothesized tree succession scenarios under different disturbance regimes are shown in appendix D-1.

Table 1.—*Examples of different vegetative communities arising in response to past treatments at two sites in the PSME/PHMA, dry phase*

Site No.	Stand letter	Treatment and year 1840	1910	1972	Dominant vegetation (overstory / undergrowth)	Seral community type	Structural stage (age)
P 11	A[1]	WF	—	—	PSME / PHMA	PSME/PHMA – CARU	Mature seral forest (137)
Sampled	B	WF	—	WF	none / PHMA, SPBE	/PHMA	Shrub – herb (5)
in 1977	C	WF	WF	—	PSME / PHMA, ACGL, AMAL	PSME/AMAL – PHMA	Pole (67)
	D	WF	WF	WF	none / CEVE, ACGL, AMAL, PHMA	/CEVE – PHMA	Shrub – herb (5)
		1865 & 1872	1900	1964			
P 42	A[2]	understory fires	—	—	PSME / PHMA, SPBE	PSME/PHMA	Mature seral forest (250) (near climax)
Sampled	B	"	WF	—	PSME / PHMA	PSME/PHMA	Pole (79)
in 1979	D	"	—	WF	none / PHMA, SPBE, CEVE	/CEVE – PHMA	Shrub – herb (15)
	C	"	WF	WF	none / CEVE, SASC, PHMA	/CEVE – PHMA	Shrub – herb (15)
	E	"	—	BB	none / SPBE, CEVE, PHMA	/CEVE – PHMA	Shrub – herb (15)

Species abbreviations:
- ACGL = *Acer glabrum*
- AMAL = *Amelanchier alnifolia*
- CEVE = *Ceanothus velutinus*
- CARU = *Calamagrostis rubescens*
- PHMA = *Physocarpus malvaceus*
- SASC = *Salix scouleriana*
- SPBE = *Spiraea betulifolia*
- PSME = *Pseudotsuga menziesii*

Treatment abbreviations:
- BB = clearcut and broadcast burned
- WF = stand – replacing wildfire

[1]Plant Creek site: 5,500 ft (1 680 m) elev., SE. aspect, 11 mi (18 km) SE. of Missoula, MT.
[2]Second Creek site: 5,300 ft (1 620 m) elev., SW. aspect, 10 mi (16 km) ESE. of Superior, MT.

2. *Pseudotsuga menziesii/Physocarpus malvaceus* (PSME/PHMA), Moist Phase

Site characteristics.—This phase is not as widespread in western Montana as the dry phase. It is essentially absent in the Bitterroot River drainage south of Stevensville and in the Clark Fork drainage east of Rock Creek. The moist phase occurs primarily on moderate to steep, north- and east-facing slopes and was sampled between 3,400 and 5,300 ft (1 040 and 1 620 m) in elevation. It often occurs on south-facing slopes in the moist areas of northwestern Montana. It usually does not extend as high as the dry phase, but instead, is replaced by cooler habitat types near the 5,000-ft (1 525-m) level. Our site-index data for the moist phase are similar to those of Pfister and others (1977) for the entire habitat type (appendix C).

Successional classification.—The following key to the successional classification for the PSME/PHMA moist phase (fig. 6), should be used to determine the appropriate community type for an unclassified stand.

KEY TO SUCCESSIONAL COMMUNITY TYPES WITHIN THE PSME/PHMA, MOIST PHASE

Moist phase sites are those that can support appreciable amounts (>5 percent canopy coverage) of western larch, as indicated on page 9.

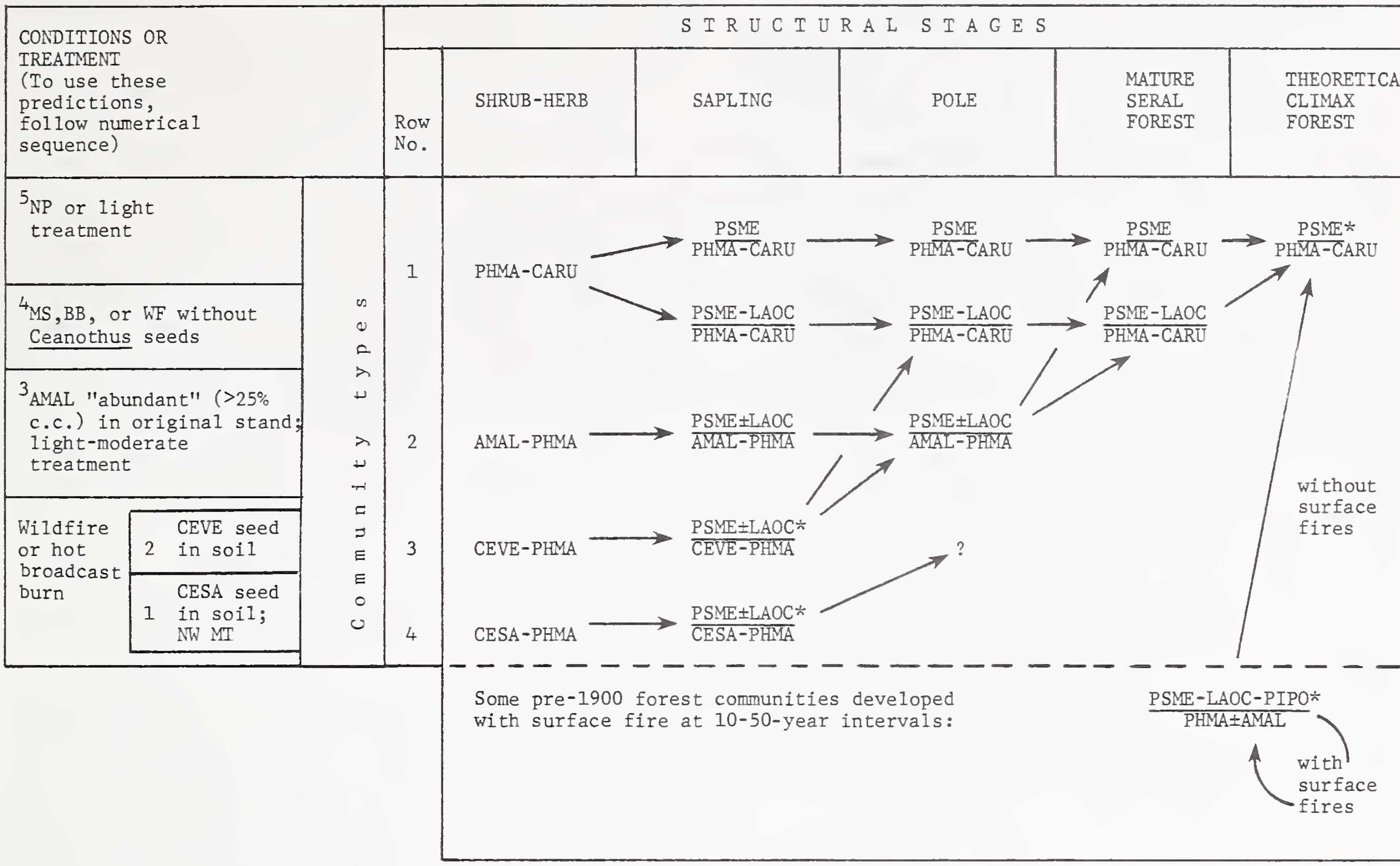
1. Select the most appropriate **community type row number** for the stand in question through use of the undergrowth key below (first priority). Then compare the tree species composition (second priority) with the community type names for that row in figure 6.

Stop at the first requirement that fits:[3]	COMMUNITY TYPE ROW NUMBER (in fig. 6)
a. *Ceanothus sanguineus* >5% canopy coverage (C.C.)	4
b. *Ceanothus velutinus* >5% C.C.	3
c. *Amelanchier alnifolia* or *Acer glabrum* or *Salix scouleriana* or their combined coverages >15%	2
d. *Calamagrostis rubescens* or *Carex geyeri* or their combined coverages >25% (If *Larix occidentalis* is well represented among trees or regeneration, choose the PSME-LAOC overstory pathway.)	1

2. Select the most appropriate **structural stage** for the stand by comparing it with the stand characteristic values listed in figure 6 for tree canopy coverage, average d.b.h. of dominant trees, stand basal area, and stand age.

3. Inspect appendix A-2, which shows constancy and average canopy coverages of different species in each community type. Is the stand in question compositionally similar to sample stands shown in the indicated community type? If so, it apparently "fits" that community type. If it is dissimilar in terms of major component species, compare it with the other community types listed. It may fit one of those types, or it may not fit this classification at all, which was true of one of the 80 stands (1.3 percent) we sampled.

[3]In stands where undergrowth is obviously depauperate (unusually sparse) because of dense shading or duff accumulations, coverage requirements for the climax species (in this case, community type row 1) can be reduced.



Stand Characteristics by Structural Stage
(Range represents about 90% of the data; extreme values are shown in parentheses)

		Shrub-herb	Sapling	Pole	Mature seral forest	Theoretical climax forest
Range of values from sample stands	Tree canopy coverage percent	0 - 15(30)	20 - 75	65 - 90	40 - 70	
	Average d.b.h. of dominant trees (inches)	0 - 2	2 - 5	6 - 12	11 - 18	
	Basal area (ft^2/acre)	0 - 3	8 - 55(180)	(47)70 - 210	140 - 210+	
	Stand age (yr)	3 - 20	13 - 45(58)	55 - 90	90 - 250	
Number of sample stands		39	18	11	11	

TREATMENT CODES:
- BB = Clearcut with broadcast burn
- MS = Clearcut with mechanical scarification (dozerpile and burn)
- NP = Clearcut with no site or slash treatment
- WF = Stand replacing wildfire
- ± = with or without

TREES:
- PSME = Pseudotsuga menziesii
- LAOC = Larix occidentalis
- PIPO = Pinus ponderosa

UNDERGROWTH:
- CESA = Ceanothus sanguineus
- CEVE = Ceanothus velutinus
- PHMA = Physocarpus malvaceus
- AMAL = Amelanchier alnifolia (alternate indicators for AMAL are Acer glabrum and Salix scouleriana)
- CARU = Calamagrostis rubescens (alternate indicator for CARU is Carex geyeri)

Figure 6.—Successional community types (with natural tree regeneration) on the PSME/PHMA moist phase in western Montana. (Moist phase sites are those that can support appreciable amounts [>5 percent canopy coverage] of western larch.) Constancy and coverage data for each community type are shown in appendix A-2. An asterisk indicates hypothesized community types without data. The box at left shows the relationship of conditions and treatment to posttreatment community type, based on our data.

INTERPRETATIONS OF SUCCESSION

Undergrowth.—It appears that only the PHMA-CARU undergrowth community persists beneath mature stands (fig. 6). The CARU and CAGE component of this community maintained or quickly reestablished itself regardless of site preparation. Undergrowth succession parallels that found on the dry phase except for the addition of a CESA-PHMA community type (in the western part of northwestern Montana) and that AMAL, ACGL, and SASC do not remain as a major component in mature stands. Responses of undergrowth species by treatment are discussed in the Species Response section.

Trees.—Tree regeneration was not as delayed as in the dry phase. Fully stocked natural regeneration was established within 10 years in about half the stands. The delayed natural regeneration that occurred in other stands was nearly all Douglas-fir. After the fire or scarification treatments, Douglas-fir and western larch usually regenerated, eventually developing into mixed, mature seral forests. Half of the untreated mature stands sampled had been underburned by wildfires prior to 1920. In these stands light to moderate surface fires generally at 10- to 50-year intervals maintained open, mature forests of Douglas-fir, larch, and ponderosa pine as illustrated in figure 6, lower right. Hypothesized tree succession scenarios under different disturbance regimes are shown in appendix D-2.

3. *Pseudotsuga menziesii/Vaccinium globulare, Xerophyllum tenax* Phase (PSME/VAGL,XETE)

Site characteristics.—This phase is widespread throughout the study area on moderate to steep slopes (on all aspects, but least commonly northern aspects). Our sample stands were located between 4,800 and 6,800 ft (1 460 and 2 070 m) in elevation. Our site-index and maximum-height data (appendix C) substantially agree with those of Pfister and others (1977) for their PSME/VAGL h.t. as a whole. Our Douglas-fir site indexes appear to be higher; however, we sampled more young vigorous stands than did Pfister and others.

Successional classification.—The following key to the successional classification for PSME/VAGL, XETE phase (fig. 7), should be used to determine the appropriate community type for an unclassified stand.

KEY TO SUCCESSIONAL COMMUNITY TYPES WITHIN THE PSME/VAGL, XETE PHASE

ABLA/XETE h.t., VAGL phase sites (Pfister and others 1977) where ABLA is poorly represented in mature stands are included here, as indicated on page 9.

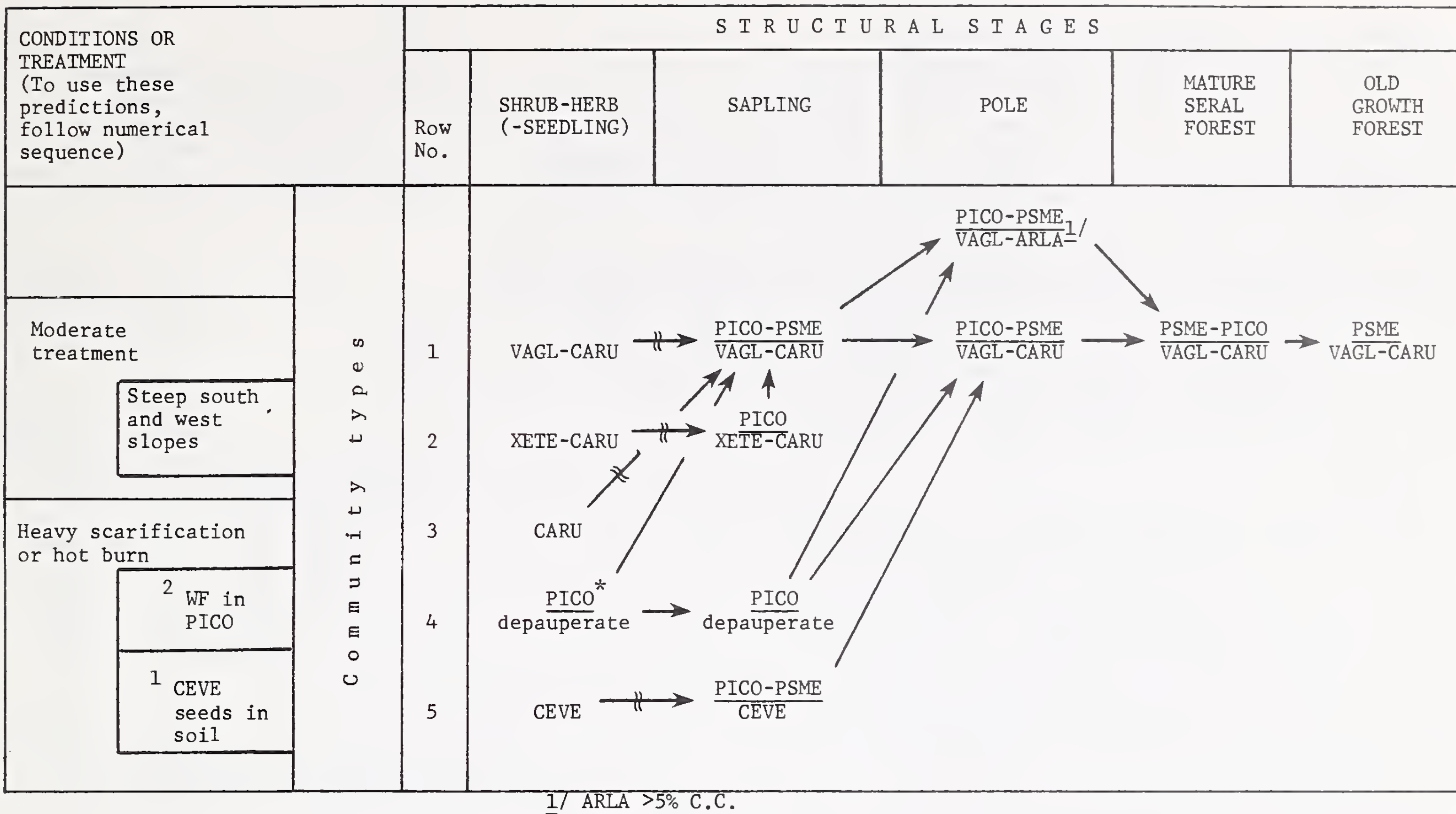
1. Select the most appropriate **community type row number** for the stand in question through use of the undergrowth key below (first priority). Then compare the tree species composition (second priority) with the community type names for that row in figure 7.

Stop at the first requirement that fits:[4]	COMMUNITY TYPE ROW NUMBER (in fig. 7)
a. *Ceanothus velutinus* > 5% canopy coverage (C.C.)	5
b. *Vaccinium globulare* > 5% C.C.	1
c. *Xerophyllum tenax* > 5% C.C.	2
d. *Calamagrostis rubescens* or *Carex geyeri* or their combined coverages > 25%	3
e. Dense *Pinus contorta* seedling or saplings	4

2. Select the most appropriate **structural stage** for the stand by comparing it with the stand characteristic values listed in figure 7 for tree canopy coverage, average d.b.h. of dominant trees, stand basal area, and stand age.

3. Inspect appendix A-3, which shows constancy and average canopy coverages of different species in each community type. Is the stand in question compositionally similar to sample stands shown in the indicated community type? If so, it apparently "fits" that community type. If it is dissimilar in terms of major component species, compare it with the other community types listed. It may fit one of those types, or it may not fit this classification at all, which was true of three of the 124 stands (2.4 percent) we sampled.

[4]In stands where undergrowth is obviously depauperate (unusually sparse) because of dense shading or duff accumulations, coverage requirements for the climax species (in this case, community type row 1) can be reduced.



Stand Characteristics by Structural Stage
(Range represents about 90% of the data; extreme values are shown in parentheses)

		SHRUB-HERB (-SEEDLING)	SAPLING	POLE	MATURE SERAL FOREST	OLD GROWTH FOREST
Range of values from sample stands	Tree canopy coverage percent	0 - 15(30)	15 - 90	60 - 90	55[2/] - 72	45 - 70
	Average d.b.h. of dominant trees (inches)	0 - 2	2 - 5	6 - 10	11 - 16	14 - 24
	Basal area (ft^2/acre)	0 - 9	3 - 90(143)	45 - 130(321)	120 - 240	140 - 330
	Stand age (yr)	4 - 23	12 - 32(54)	(25)39 - 90	100 - 230	190 - 300+
Number of sample stands		51	33	13	9	15

TREES:
PICO = Pinus contorta
PSME = Pseudotsuga menziesii
≀≀ = Establishment of tree regeneration delayed ≥ 20 years

UNDERGROWTH:
CEVE = Ceanothus velutinus
CARU = Calamagrostis rubescens
VAGL = Vaccinium globulare
XETE = Xerophyllum tenax
ARLA = Arnica latifolia

2/ In two stands one-half or less of the coverage was from overstory trees.

Figure 7.—Successional community types (with natural tree regeneration) on the PSME/VAGL, XETE phase in western Montana (including ABLA/XETE h.t., VAGL phase sites where ABLA is poorly represented in mature stands). Constancy and coverage data for each community type are shown in appendix A-3. An asterisk indicates hypothesized community types without data. The box at left shows the relationship of conditions and treatment to posttreatment community type, based on our data.

INTERPRETATIONS OF SUCCESSION

Undergrowth.—The VAGL-CARU undergrowth (fig. 7, row 1), which includes XETE, is persistent in old stands and remains dominant after light to moderate intensity clearcut and burn treatments on "moderate" topographic sites—namely, **not** on steep south-to-west aspects or on sites with very coarse surface soils. In contrast, on severely wind- or sun-exposed sites, VAGL decreases drastically in coverage even after a clearcut with no site or slash treatment or a light broadcast burn. This results in a XETE-CARU community type (row 2). Our observations suggest that the stems of VAGL are killed back by subzero (degrees Fahrenheit) temperatures when there is little snowpack on these exposed sites.

If there is CEVE seed in the soil, a hot burn will result in the CEVE community type (row 5). Otherwise, a hot burn, heavy scarification, or a moderate treatment on a severely exposed site kills most XETE plants, as well as VAGL, and generally yields a CARU and CAGE dominated community (row 3). After a hot wildfire in a lodgepole pine stand (example, the Sleeping Child Burn), the tendency was to regenerate a dense (doghair) community of lodgepole pine seedlings with depauperate undergrowth (row 4).

All seral undergrowth communities evidently develop into VAGL-CARU beneath the dense overstory of a pole stage. Sometimes the CARU and CAGE element apparently was largely shaded out by this dense overstory and ARLA replaced the grasses. As the stand matured and became less shady, however, the CARU and CAGE again became abundant (>25 percent canopy coverage).

Table 2 gives an example of how different treatments sometimes produce diverse responses on a single site on this habitat type. Figure 2 (p. 3) is a map of these stands. VAGL was severely reduced in stand 10D by simply removing the forest cover (NP treatment) and exposing the undergrowth to sun, wind, and frost or winter desiccation damage on this dry, south slope. A similar result occurred after wildfire (stand 10C) except that mineral soil was exposed, allowing lodgepole pine to regenerate. The scraping and hot burning of dozer piles in 10E killed XETE as well as VAGL and allowed a denser stand of lodgepole pine and seral shrubs to develop.

Trees.—Full stocking of natural regeneration usually required 20 years or more for establishment, except after wildfire and sometimes after scarification treatments. Lodgepole pine regenerated more successfully than other species in most stands. Planting (1960's to mid-1970's practices) was usually judged unsuccessful in our sample stands. Lodgepole pine dominated the early stages of tree succession after wildfire, and often after clearcutting with site or slash treatments. Douglas-fir increases in the understory and assumes dominance in the mature seral forest stage. Larch is often a minor component of seral stands. More than 60 percent of the mature stands sampled had experienced one or more understory wildfires prior to 1920.

Table 2.—*Examples of different vegetative communities arising in response to past treatments at one site in the PSME/VAGL, XETE potential vegetation type*

Site No.	Stand letter	Treatment and year 1910	Treatment and year 1964	Dominant vegetation Overstory / Undergrowth	Seral community type	Structural stage (age in years)
X-10	A[1]	—	—	PSME–ABLA / XETE, VAGL	PSME/VAGL–CARU	Old growth forest (250)
Sampled	B	WF	—	PICO–PSME / VAGL, XETE	PICO–PSME/VAGL–ARLA	Pole (68)
in 1978	D	—	NP	none / XETE, CARU	XETE–CARU	Shrub–herb (14)
	C	—	WF	PICO / XETE, CARU	PICO/XETE–CARU	Sapling (14)
	E	—	MS	PICO / CEVE, SASC	PICO–PSME/CEVE	Sapling (14)

Species abbreviations:
- CEVE = *Ceanothus velutinus*
- CARU = *Calamagrostis rubescens*
- SASC = *Salix scouleriana*
- VAGL = *Vaccinium globulare*
- XETE = *Xerophyllum tenax*
- ABLA = *Abies lasiocarpa*
- PICO = *Pinus contorta*
- PSME = *Pseudotsuga menziesii*

Treatment abbreviations:
- MS = clearcut and mechanically scarified
- NP = clearcut with no site preparation
- WF = stand-replacing wildfire

[1]Saint Mary Peak site: 6,600 ft (2 010 m) elevation, south aspect, 5 miles west of Stevensville, MT.

4. *Abies lasiocarpa/Xerophyllum tenax, Vaccinium globulare* Phase (ABLA/XETE, VAGL)

Site characteristics.—This phase is abundant in the study area and was found primarily at elevations of 5,000 to 7,200 ft (1 520 to 2 200 m) usually on moderate to steep slopes, often directly upslope from the PSME/VAGL, XETE phase. It was found on all aspects but was less common on north and east aspects. Our site-index and maximum-height data (appendix B) are similar to those of Pfister and others (1977) for the entire ABLA/XETE habitat type.

Successional classification.—The following key to the successional classification for the ABLA/XETE, VAGL phase (fig. 8), should be used to determine the appropriate community type for an unclassified stand.

KEY TO SUCCESSIONAL COMMUNITY TYPES WITHIN THE ABLA/XETE, VAGL PHASE

Sites where ABLA is poorly represented in mature stands are included in our PSME/VAGL h.t. classification, as indicated on page 9.

1. Select the most appropriate **community type row number** for the stand in question through use of the undergrowth key below (first priority). Then compare the tree species composition (second priority) with the community type names for that row in figure 8.

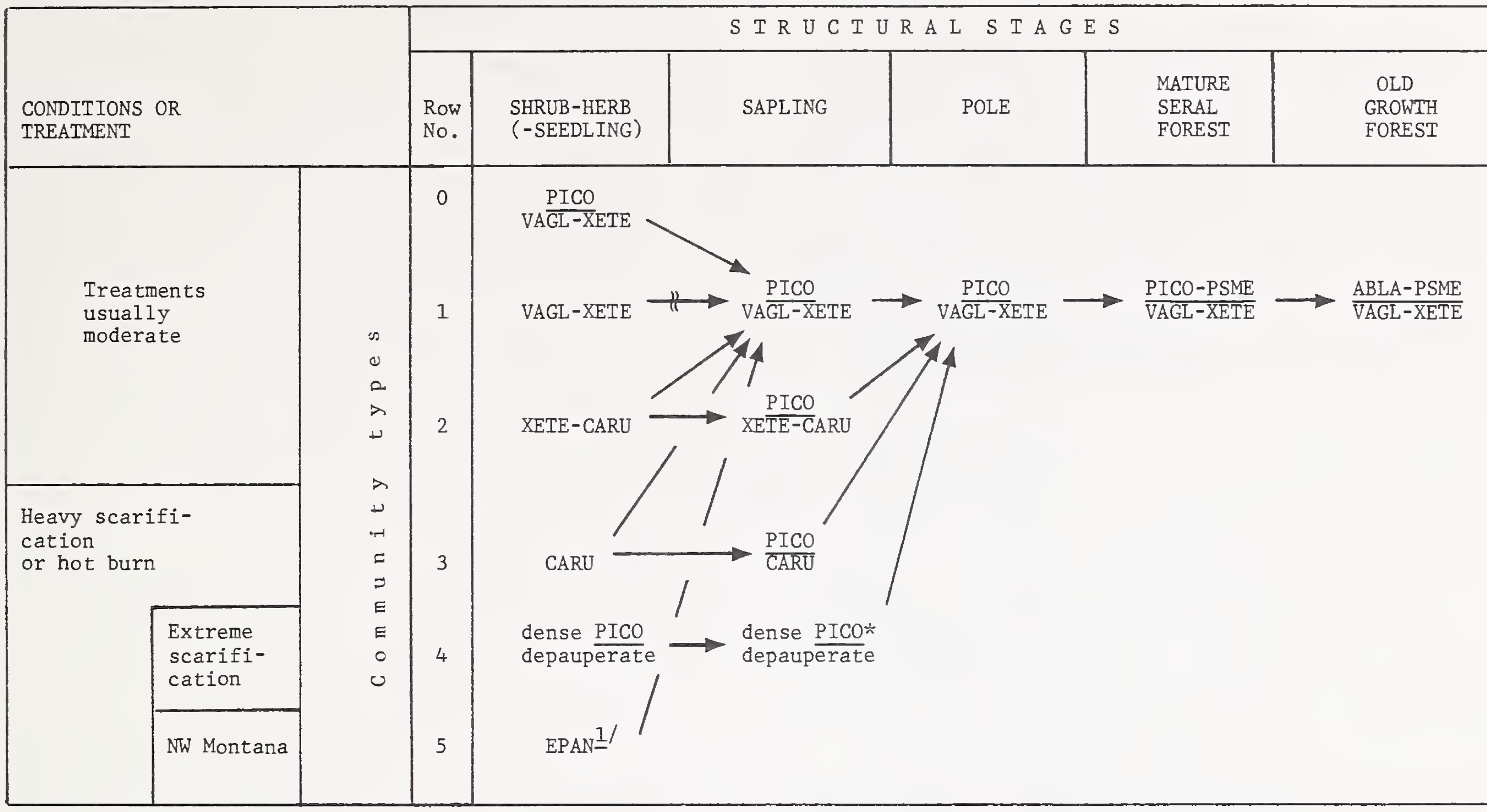
Stop at the first requirement that fits:[5]	COMMUNITY TYPE ROW NUMBER (in fig. 8)
a. *Epilobium angustifolium* or *Anaphalis margaritacea* or their combined coverages >25%	5
b. *Vaccinium globulare* >5% canopy coverage (C.C.) and *Pinus contorta* or *Larix* or *Pseudotsuga* seedlings or their combined coverages >15%	0
c. *Vaccinium globulare* >5% C.C.	1
d. *Xerophyllum tenax* >5% C.C.	2
e. *Calamagrostis rubescens* or *Carex geyeri* or their combined coverages >25%	3
f. Not as above; dense *Pinus contorta* seedlings or saplings	4

2. Select the most appropriate **structural stage** for the stand by comparing it with the stand characteristic values listed in figure 8 for tree canopy coverage, average d.b.h. of dominant trees, stand basal area, and stand age.

3. Inspect appendix A-4, which shows constancy and average canopy coverages of different species in each community type. Is the stand in question compositionally similar to sample stands shown in the indicated community type? If so, it apparently "fits" that community type. If it is dissimilar in terms of major component species, compare it with the other community types listed. It may fit one of those types, or it may not fit this classification at all, which was true of two of the 127 stands (1.6 percent) we sampled.

---

[5]In stands where undergrowth is obviously depauperate (unusually sparse) because of dense shading or duff accumulations, coverage requirements for the climax species (in this case, community type row 1) can be reduced.



Stand Characteristics by Structural Stage (Range represents about 90% of the data; extreme values are shown in parentheses)		Shrub-herb (-seedling)	Sapling	Pole	Mature seral forest	Old growth forest
Range of values from sample stands	Tree canopy coverage percent	0 - 15(70)	15 - 60(90)	55 - 90	30 - 70	40 - 90
	Average d.b.h. of dominant trees (inches)	0 - 2	2 - 5	5 - 11	10 - 15(19)	12 - 22
	Basal area (ft^2/acre)	0 - 6	3 - 60	60 - 200(393)	70 - 300	(68)120 - 330
	Stand age (yr)	4 - 22	(12)15 - 41(80)	41 - 105	130 - 250	(150)220 - 300+
Number of sample stands		57	28	17	14	9

TREES:
ABLA = Abies lasiocarpa
PICO = Pinus contorta
PSME = Pseudotsuga menziesii

UNDERGROWTH:
CARU = Calamagrostis rubescens
VAGL = Vaccinium globulare
XETE = Xerophyllum tenax
EPAN = Epilobium angustifolium

≀≀ = Establishment of tree regeneration delayed = 20 years.

1/ Occasionally Ribes viscosissimum dominates in sites that are nearly ABLA/MEFE h.t.

Figure 8.—Successional community types (with natural tree regeneration) on the ABLA/XETE, VAGL phase in western Montana. Constancy and coverage data for each community type are shown in appendix A-4. An asterisk indicates hypothesized community types without data. The box at left shows the relationship of conditions and treatment to posttreatment community type, based on our data.

INTERPRETATIONS OF SUCCESSION

Undergrowth.—The VAGL-XETE undergrowth (fig. 8, row 1) persists in mature stands and remains dominant after clearcutting with light to moderate site or slash treatments. VAGL-XETE seems better able to maintain dominance after treatment in northwestern Montana compared to the generally drier areas of west-central Montana (Arno 1979). In a manner similar to that of the PSME/VAGL classification, VAGL decreases as a result of moderately heavy treatments or harsh topographic sites. In these cases, XETE persists and CARU and CAGE increase to form the XETE-CARU community (row 2).

Clearcutting followed by heavy scarification or hot burning treatments usually reduce both VAGL and XETE. In northwestern Montana, these treatments generally resulted in dominance by EPAN (row 5). In west-central Montana extreme scarification—such as on fire lines, major skid trails, and at landings—generally resulted in dense (doghair) lodgepole pine seedlings with depauperate undergrowth (row 4). Otherwise, heavy scarification or hot burning usually resulted in a CARU (and CAGE) community type (row 3). All seral undergrowth communities evidently develop into VAGL-XETE under the influence of a dense pole stage canopy. A possible exception to this return to VAGL-XETE was observed, but not sampled, in some scarified clearcuts that have been heavily grazed for many years and have developed an alternate vegetation dominated by exotic grasses and forbs in place of the native flora.

Trees.—Full stocking of natural regeneration usually required more than 15 years after clearcutting without site or slash treatment or with broadcast burning. In contrast, lodgepole pine regenerated promptly after wildfire, and on scarified sites regeneration was prompt about half the time. In our sample stands, planting (1960's to mid-1970's practices) was usually either superfluous or unsuccessful (Fiedler 1982).

After all treatments, tree succession was dominated by lodgepole pine. By the mature seral forest stage, Douglas-fir becomes a codominant in the overstory. In the old-growth stage, lodgepole pine has essentially died out while subalpine fir has developed into the dominant understory, and it codominates with Douglas-fir in the overstory. Western larch and Engelmann spruce are sometimes secondary components of natural stands. About 40 percent of the mature stands had experienced an understory wildfire prior to 1920; such fires readily killed subalpine fir, but generally did not kill overstory Douglas-fir and larch. Lodgepole pine is able to survive light surface fires.

Hypothesized tree succession scenarios under different disturbance regimes are shown in appendix D-4.

5. *Abies lasiocarpa/Xerophyllum tenax, Vaccinium scoparium* Phase (ABLA/XETE, VASC)

Site characteristics.—This phase is common in the drier, high mountain portions of the study area, particularly in the Sapphire Range east of the Bitterroot Valley. It was found on moderate slopes, usually with south or west aspects, and on ridgetops. Most sites were between 6,400 and 7,300 ft (1 950 and 2 225 m) in elevation except in northwestern Montana, where elevations were about 1,000 ft (300 m) lower. Surface soils tend to be sandy loams, somewhat coarser on the average than those of the VAGL phase. Our site-index and maximum-height data (appendix C) confirm observations of some foresters that the VASC phase is substantially less productive than the VAGL phase. Moreover, the VASC phase appears to be substantially less productive than all six other habitat type phases studied.

Successional classification.—The following key to the successional classification for the ABLA/XETE, VASC phase (fig. 9), should be used to determine the appropriate community type for an unclassified stand.

KEY TO SUCCESSIONAL COMMUNITY TYPES WITHIN THE ABLA/XETE, VASC PHASE

This potential vegetation type is the same as the ABLA/XETE h.t., VASC phase of Pfister and others (1977) as indicated on page 9.

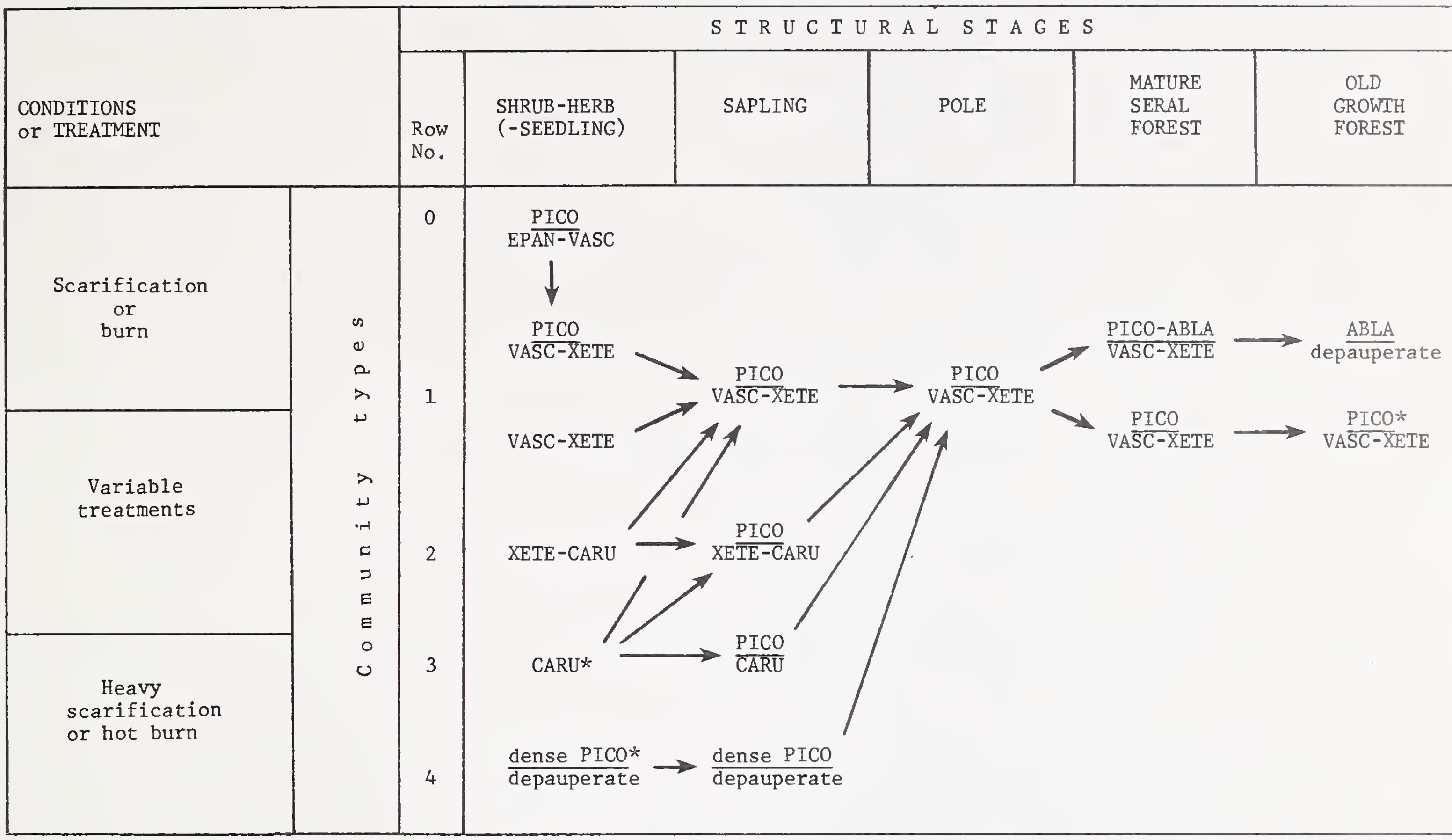
1. Select the most appropriate **community type row number** for the stand in question through use of the undergrowth key below (first priority). Then compare the tree species composition (second priority) with the community type names for that row in figure 9.

Stop at the first requirement that fits:[6]	COMMUNITY TYPE ROW NUMBER (in fig. 9)
a. *Epilobium angustifolium* or *Anaphalis margaritacea* or their combined coverages >25% and *Pinus contorta* seedlings >15% canopy coverage (C.C.)	0
b. *Vaccinium scoparium* >5% C.C.	1
c. *Xerophyllum tenax* >5% C.C.	2
d. *Calamagrostis rubescens* or *Carex geyeri* or their combined coverages >25%	3
e. Not as above; dense *Pinus contorta* seedlings or saplings.	4

2. Select the most appropriate **structural stage** for the stand by comparing it with the stand characteristic values listed in figure 9 for tree canopy coverage, average d.b.h. of dominant trees, stand basal area, and stand age.

3. Inspect appendix A-5, which shows constancy and average canopy coverages of different species in each community type. Is the stand in question compositionally similar to sample stands shown in the indicated community type? If so, it apparently "fits" that community type. If it is dissimilar in terms of major component species, compare it with the other community types listed. It may fit one of those types, or it may not fit this classification at all, which was true of three of the 80 stands (3.7 percent) we sampled.

[6]In stands where undergrowth is obviously depauperate (unusually sparse) because of dense shading or duff accumulations, coverage requirements for the climax species (in this case, community type row 1) can be reduced.



Stand Characteristics by Structural Stage
(Range represents about 90% of the data; extreme values are shown in parentheses)

		SHRUB-HERB (-SEEDLING)	SAPLING	POLE	MATURE SERAL FOREST	OLD GROWTH FOREST
Range of values from sample stands	Tree canopy coverage percent	T - 15(35)	15 - 80	(30)70 - 85	20 - 65	70
	Average d.b.h. of dominant trees (inches)	0 - 1	1 - 4	6 - 10	8 - 14	15
	Basal area (ft^2/acre)	0 - 2(9)	2 - 35	(20)95 - 216	70 - 150	267
	Stand age (yr)	4 - 22	7 - 41(62)	(26)61 - 120	140 - 220	260
Number of sample stands		22	40	6	8	1

TREATMENT CODES:
NP = Clearcut with no site or slash treatment
MS = Clearcut with mechanical scarification (Dozerpile and burn)
WF = Stand-replacing wildfire

TREES:
ABLA = Abies lasiocarpa
PICO = Pinus contorta

UNDERGROWTH:
CARU = Calamagrostis rubescens (alternate indicator for CARU is Carex geyeri)
VASC = Vaccinium scoparium
XETE = Xerophyllum tenax
EPAN = Epilobium angustifolium (alternate indicator for EPAN is Anaphalis margaritacea)

Figure 9.—Successional community types (with natural tree regeneration) on the ABLA/XETE, VASC phase in western Montana. Constancy and coverage data for each community type are shown in appendix A-5. An asterisk indicates hypothesized community types without data. The box at left shows the relationship of conditions and treatment to posttreatment community type, based on our data.

INTERPRETATIONS OF SUCCESSION

Undergrowth.—The VASC-XETE undergrowth (fig. 9, row 1) persists in mature stands and generally remains dominant after clearcutting with low-intensity site or slash treatments. With moderately heavy site or slash treatments, VASC decreases dramatically. Sometimes a XETE-CARU (including CAGE) community results (row 2). Heavy scarification kills the XETE, sometimes resulting in a CARU community (row 3). Extreme scarification—such as a fireline, major skid trail, or landing—probably results in a dense lodgepole pine seedling community with depauperate undergrowth (row 4). Stand-replacing wildfire evidently results in dense lodgepole pine seedlings, but with a VASC-XETE undergrowth (row 1). Sometimes EPAN is added as a major component with pine seedlings and VASC (row 0). All the seral undergrowth communities merge toward VASC-XETE at least by the time a pole canopy develops. Virtually all undergrowth may become shaded out if a near-climax subalpine fir stand develops.

Trees.—Natural regeneration of lodgepole pine was generally good on these sites. Tree succession after all treatments is dominated by lodgepole pine, and this species remains the sole dominant in most stands until the mature seral forest stage. In that stage two patterns of overstory development were noted. On some sites (presumably moist ones), subalpine fir essentially replaces lodgepole pine in the old-growth stage. On other sites, subalpine fir remains scattered and lodgepole maintains dominance, evidently regenerating in openings. These latter situations have been recognized in Pfister and others (1977) as "*Pinus contorta* community types."

Two-thirds of the mature stands sampled had experienced a surface fire since their establishment. Usually this had occurred when the stand was in a pole or mature seral forest stage, before heavy overstory mortality and stand breakup.

Hypothesized tree succession scenarios under different disturbance regimes are shown in appendix D-5.

6. *Abies lasiocarpa/Menziesia ferruginea* (ABLA/MEFE), Warm Phase

Site characteristics.—This phase is common throughout the study area on moderate to steep northwest to east exposures, mostly between 5,000 and 6,800 ft (1 525 and 2 075 m) in elevation. Our data include three sample sites that are classified ABLA/CLUN h.t., MEFE phase (Pfister and others 1977), but are near the upper limits of that type and, for our purposes, are seemingly comparable to the other sites. Our site-index and maximum-height data for the warm phase are similar to those of Pfister and others (1977) for the entire habitat type (appendix C). Note that *Picea* site-indexes are based on breast-high age, while other species are based on total age.

Successional classification.—The following key to the successional classification for the ABLA/MEFE warm phase (fig. 10), should be used to determine the appropriate community type for an unclassified stand.

KEY TO SUCCESSIONAL COMMUNITY TYPES WITHIN THE ABLA/MEFE, WARM PHASE

As indicated on page 9, warm phase sites are those where PSME or LAOC are common; additionally VASC is not abundant.

1. Select the most appropriate **community type row number** for the stand in question through use of the undergrowth key below (first priority). Then compare the tree species composition (second priority) with the community type names for that row in figure 10.

	COMMUNITY TYPE ROW NUMBER (in fig. 10)
PART I—applies to shrub-herb and sapling stages	
Stop at the first requirement that fits:[7]	
a. *Menziesia ferruginea* >5% and *Epilobium angustifolium* >5%	2
b. *Menziesia ferruginea* >5%	1
c. *Vaccinium globulare* >5%	3
d. *Salix scouleriana* >5%	5
e. *Ribes viscossimum* >5%	6
f. *Epilobium angustifolium* or *Anaphalis margaritacea* or their combined coverages >25%	4
g. *Arnica latifolia* >25%	7
PART II—applies to pole and older stages	
a. *Abies lasiocarpa* stands; other tree species are poorly represented	1
b. *Abies lasiocarpa* a major overstory component, but other tree species are well represented	2
c. Other species are the major overstory components	3

2. Select the most appropriate **structural stage** for the stand by comparing it with the stand characteristic values listed in figure 10 for tree canopy coverage, average d.b.h. of dominant trees, stand basal area, and stand age.

3. Inspect appendix A-6, which shows constancy and average canopy coverages of different species in each community type. Is the stand in question compositionally similar to sample stands shown in the indicated community type? If so, it apparently "fits" that community type. If it is dissimilar in terms of major component species, compare it with the other community types listed. It may fit one of those types, or it may not fit this classification at all, as was true of four of the 129 stands (3.1 percent) we sampled.

---

[7]In stands where undergrowth is obviously depauperate (unusually sparse) because of dense shading or duff accumulations, coverage requirements for the climax species (in this case, community type rows 1 and 2) can be reduced.

CONDITIONS or TREATMENT		Row No.	STRUCTURAL STAGES: SHRUB-HERB	SAPLING	POLE	MATURE SERAL FOREST	OLD GROWTH FOREST
NP or light burn		1	MEFE-VAGL →	ABLA / MEFE-VAGL →	ABLA* / MEFE-VAGL →	ABLA* / MEFE-VAGL →	ABLA* / MEFE-VAGL (theoretical climax) ↑
Scarification or burn treatments	Community types	2	EPAN-MEFE →	ABLA-(others) / MEFE-EPAN →	ABLA-(others) / MEFE-VAGL →	ABLA-(others)* / MEFE-VAGL →	ABLA-(others except PICO) / MEFE-VAGL
		3	VAGL →	5 spp. / VAGL →	5 spp. / MEFE-VAGL →	5 spp. / MEFE-VAGL ↗	
		4	EPAN →	5 spp. / EPAN ↗			
SASC seeds blown in		5	SASC →	5 spp. / SASC ↗			
RIVI seeds in soil		6	RIVI →	5 spp.* / RIVI ↗			
Undergrowth sparse in pretreatment stand		7	ARLA →	5 spp.* / ARLA →	?		

Stand Characteristics by Structural Stage
(Range represents about 90% of the data; extreme values are shown in parentheses)

		SHRUB-HERB	SAPLING	POLE	MATURE SERAL FOREST	OLD GROWTH FOREST
Range of values from sample stands	Tree canopy coverage percent	0 - 15(40)	(10)15 - 70	50 - 90	40 - 70	40 - 75
	Average d.b.h. of dominant trees (inches)	0 - 2	2 - 5	6 - 12	11 - 20	14 - 20
	Basal area (ft^2/acre)	0 - 6	5 - 25	(45)120 - 270	108 - 327	129 - 282
	Stand age (yr)	3 - 22	12 - 33	(31)54 - 80	97 - 260	200 - 300+
Number of sample stands		63	34	8	13	6

TREATMENT CODES:
- NP = Clearcut with no site or slash treatment
- BB = Clearcut with broadcast burning
- MS = Clearcut with mechanical scarification (Dozerpile and burn)
- WF = Stand-replacing wildfire

TREES:
- 5 spp. = All those listed below
- PICO = *Pinus contorta*
- PIEN = *Picea engelmannii*
- ABLA = *Abies lasiocarpa*
- PSME = *Pseudotsuga menziesii*
- LAOC = *Larix occidentalis*

UNDERGROWTH:
- MEFE = *Menziesia ferruginea*
- VAGL = *Vaccinium globulare*
- EPAN = *Epilobium angustifolium*
- SASC = *Salix scouleriana*
- ARLA = *Arnica latifolia*
- RIVI = *Ribes viscosissimum*

Figure 10.—Successional community types (with natural tree regeneration) on the ABLA/MEFE warm phase in western Montana. (Warm phase sites are those where Pseudotsuga menziesii *or* Larix occidentalis *is common.) Constancy and coverage data for each community type are shown in appendix A-6. An asterisk indicates hypothesized community types without data. The box at left shows the relationship of conditions and treatment to posttreatment community type, based on our data.*

INTERPRETATIONS OF SUCCESSION

Undergrowth.—The MEFE-VAGL undergrowth (fig. 10, row 1) persists in old stands and generally remains dominant after clearcutting with no site or slash treatment. With clearcutting and broadcast burning or scarification EPAN often joins the MEFE and VAGL (row 2), or MEFE drops out while VAGL remains and is joined by EPAN (row 3). Sometimes VAGL also dies back, leaving an EPAN community type (row 4). A scarification or hot broadcast burn treatment on a site having RIVI seeds in the soil may result in a RIVI community type (row 6), or SASC seeds may be blown in from some distance and result in a SASC community type (row 5). If the undergrowth was sparse in the pretreatment stand and a light treatment was applied, the result may be an ARLA-dominated community type (row 7); evidently MEFE and VAGL were reduced by heavy shading in the pretreatment stand, while ARLA flourished. As the various, young community types mature and reach the pole stage, MEFE-VAGL again becomes the dominant undergrowth.

Trees.—After clearcutting without site or slash treatment, natural regeneration was sometimes retarded. This regeneration consisted primarily of subalpine fir, some of which was old and defective advance regeneration. After broadcast burning and wildfire, sites were usually fully stocked with natural regeneration within 10 years. This was primarily lodgepole pine and secondarily Engelmann spruce. Scarified clearcuts usually regenerated within 15 years; spruce was the most common species, followed by lodgepole pine. Douglas-fir or larch were often successful when planted (1960's to mid-1970's practices).

Where site treatment following clearcutting was light, subalpine fir became the dominant tree from the sapling stage onward (fig. 10, rows 1 and 2). After moderate to heavy treatments, including stand-replacing wildfire, any combination of five tree species—lodgepole pine, Engelmann spruce, subalpine fir, Douglas-fir, and western larch—may dominate through the mature seral forest stage. By the time an old-growth forest has developed, lodgepole pine has died out. In the old-growth stage, subalpine fir dominates the understory and is at least a codominant in the overstory along with veteran spruce, larch, or Douglas-fir. More than 50 percent of the mature stands sampled had experienced an understory wildfire; this would have favored perpetuation of the four seral tree species.

7. *Abies lasiocarpa/Menziesia ferruginea* (ABLA/MEFE), Cold Phase

Site characteristics.—This phase is common near the highest elevations of commercial forest growth on moist sites. It was sampled between 6,000 and 7,300 ft (1 830 and 2 225 m) (down to 5,600 ft [1 710 m] in northwestern Montana) on moderate to steep slopes generally having northwest to east aspects. It sometimes occurred on broad ridgetops. The limited site-index and maximum-height data (appendix C) suggest that this phase is less productive than the warm phase.

Successional classification.—The following key to the successional classification for the ABLA/MEFE cold phase (fig. 11), should be used to determine the appropriate community type for an unclassified stand.

KEY TO SUCCESSIONAL COMMUNITY TYPES WITHIN THE ABLA/MEFE, COLD PHASE

As indicated on page 9, cold phase sites are those where PSME and LAOC are scarce in stands of all ages; additionally VASC is often abundant.

1. Select the most appropriate **community type row number** for the stand in question through use of the undergrowth key below (first priority). Then compare the tree species composition (second priority) with the community type names for that row in figure 11.

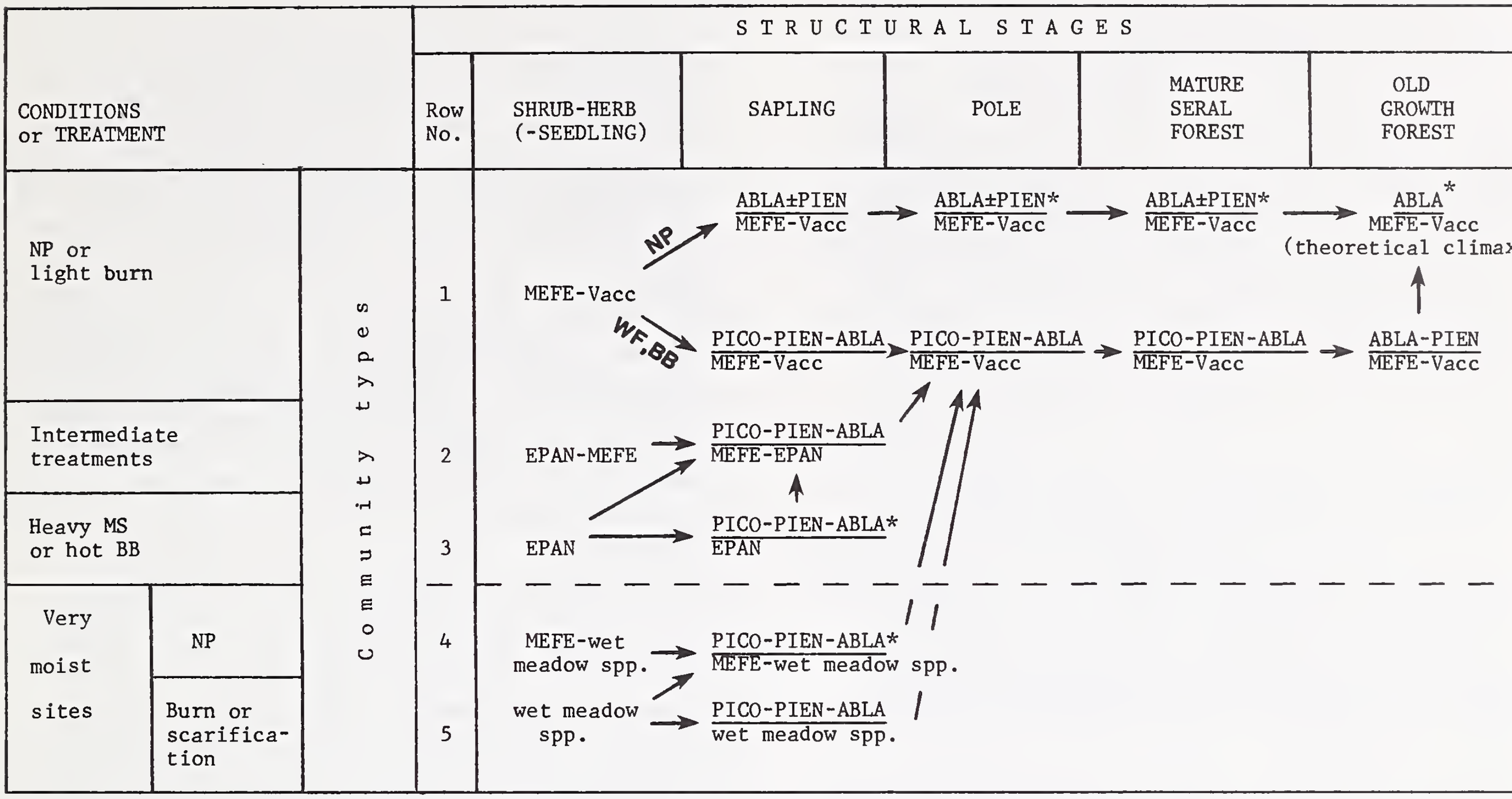
Stop at the first requirement that fits:[8]	COMMUNITY TYPE ROW NUMBER (in fig. 11)
a. *Senecio triangularis* or *Veratrum viride* or wet site graminoids (listed on page 36) or their combined coverages >1% and *Menziesia ferruginea* <25% canopy coverage (C.C.)	5
b. *Senecio triangularis* or *Veratrum viride* or wet site graminoids or their combined coverages >1% and *Menziesia ferruginea* >25% C.C.	4
c. *Menziesia ferruginea* >5% and *Epilobium angustifolium* >5% C.C.	2
d. *Menziesia ferruginea* >5% C.C.	1
e. *Epilobium angustifolium* >25% C.C.	3

2. Select the most appropriate **structural stage** for the stand by comparing it with the stand characteristic values listed in figure 11 for tree canopy coverage, average d.b.h. of dominant trees, stand basal area, and stand age.

3. Inspect appendix A-7, which shows constancy and average canopy coverages of different species in each community type. Is the stand in question compositionally similar to sample stands shown in the indicated community type? If so, it apparently "fits" that community type. If it is dissimilar in terms of major component species, compare it with the other community types listed. It may fit one of those types, or it may not fit this classification at all, which was true of three of the 82 stands (3.7 percent) we sampled.

---

[8]In stands where undergrowth is obviously depauperate (unusually sparse) because of dense shading or duff accumulations, coverage requirements for the climax species (in this case, community type row 1) can be reduced.



Stand Characteristics by Structural Stage
(Range represents about 90% of the data; extreme values are shown in parentheses)

		SHRUB-HERB (-SEEDLING)	SAPLING	POLE	MATURE SERAL FOREST	OLD GROWTH FOREST
Range of values from sample stands	Tree canopy coverage	0 - 15(30)	15 - 50	60 - 80	30 - 60	40 - 60
	Average d.b.h. of dominant trees (inches)	0 - 2	2 - 5	7 - 10	11 - 14(17)	15 - 18
	Basal area (ft^2/acre)	0 - 4	5 - 45	95 - 220	117 - 274	135 - 319
	Stand age (yr)	3 - 25	12 - 29(40)	60 - 115	128 - 200	220 - 300
Number of sample stands		44	17	4	7	7

TREATMENT CODES:
- NP = Clearcut with no site or slash treatment
- BB = Clearcut with broadcast burning
- MS = Clearcut with mechanical scarification (Dozerpile and burn)
- WF = Stand-replacing wildfire
- ± = with or without

TREES:
- ABLA = Abies lasiocarpa
- PICO = Pinus contorta
- PIEN = Picea engelmannii

UNDERGROWTH:
- EPAN = Epilobium angustifolium
- MEFE = Menziesia ferruginea (XETE, Xerophyllum tenax, is a constant associate)
- Vacc = VAGL (Vaccinium globulare), VASC (Vaccinium scoparium), and VAMY (Vaccinium myrtillus).

Figure 11.—Successional community types (with natural tree regeneration) on the ABLA/MEFE cold phase in western Montana. (Cold phase sites are defined as those where Pseudotsuga menziesii *or* Larix occidentalis *are scarce.) Constancy and coverage data for each community type are shown in appendix A-7. An asterisk indicates hypothesized community types without data. The box at left shows the relationship of conditions and treatment to posttreatment community type, based on our data.*

INTREPRETATIONS OF SUCCESSION

Undergrowth.—The MEFE-Vacc (Vacc = VAGL, VASC, and *Vaccinium myrtillus*) undergrowth (fig. 11, row 1) persists in old stands and generally remains dominant after light to moderate clearcutting or fire treatments. On very moist sites within this phase, surface water appears after clearcutting with site preparation, and wet-site associates of *Calamagrostis canadensis* become common (rows 4 and 5). These wet-meadow species include *Calamagrostis canadensis, Cinna latifolia, Deschampsia atropurpurea*, various wet-site *Carex* spp., *Juncus drummondii, Senecio triangularis, Veratrum viride, Trollius laxus, Ligusticum canbyi, Dodecatheon jeffreyi*, and other wet-meadow forbs. These "wet" conditions were not evident in the untreated stands, presumably because the large trees were using the water.

On better drained sites, scarification or hot broadcast burning usually results in an early seral community type dominated by EPAN (row 3). Where the treatment is of intermediate intensity, an EPAN-MEFE community type develops (row 2). All of these seral undergrowth community types (rows 2-5) evidently give way to a MEFE-Vacc undergrowth as the pole stage of conifers begins to develop.

Trees.—Natural regeneration had become fully stocked within 10 years on more than half of the treated sites, including all those burned in wildfires or hot broadcast burns. Clearcuts without site or slash treatments or with light to moderate treatments were usually slow to regenerate and came back primarily to subalpine fir. Successfully regenerated stands were dominated by natural lodgepole pine with lesser amounts of subalpine fir and Engelmann spruce. Planting (1960's to mid-1970's practices) of spruce was partially successful.

After all treatments except clearcutting without site or slash preparation, lodgepole pine evidently develops as the overstory dominant and retains that position until the mature seral forest stage. By the old-growth stage, however, lodgepole pine dies out, leaving subalpine fir and Engelmann spruce as overstory dominants, with subalpine fir forming the understory. Spruce is a large, long-lived seral tree that depends primarily on infrequent disturbances to reestablish it in appreciable quantities. Only one of the 14 mature and old-growth sample stands showed evidence of having had an understory wildfire since stand establishment; apparently stand-replacing fires recycled these stands at long intervals.

SPECIES RESPONSE

This summary reports apparent responses of individual undergrowth species to the different kinds of treatments recorded during the current study and makes no attempt to correlate them with literature on plant response such as Fischer and Clayton (1983), Volland and Dell (1981), and Stickney (1980). Remember that our response measurements were generally made 4 to 20 years after treatment. The indicated response describes changes from conditions in the mature communities.

Shrubs

Acer glabrum is common in both phases of PSME/PHMA. It showed little change after most treatments, but generally increased after wildfire (presumably from root-crown sprouting) and maintained greater canopy coverage in the form of very tall shrubs growing among pole-stage conifers. Browsing by big game may locally prevent full development of this shrub.

Alnus sinuata is common, as a minor stand component, only in the ABLA/MEFE warm phase. It showed little change after most treatments, but increased moderately after WF and BB (treatment codes are explained in fig. 6). Along the cuts, fills, and beds of roads and some other "extreme scarification" microsites, it sometimes increases dramatically (from seeding) to form dense strips.

Amelanchier alnifolia is ubiquitous, and occasionally a major component, in PSME/PHMA. It generally increased (presumably from root crowns) after WF and other treatments, although this response was sometimes delayed a decade or more. In some areas, big game browsing pressure may be sufficient to stifle increases. Scarification treatments produced little change or possibly a decrease; this may result from destruction of root crowns. This species maintains relatively great canopy coverage as very tall shrubs growing among pole-stage conifers. It was sometimes common in PSME/VAGL sites, but exhibited little change after all treatments there.

Ceanothus sanguineus occasionally becomes abundant after burning treatments on north aspects in the PSME/PHMA moist phase in the western portion of northwestern Montana. This species becomes widespread westward in northern Idaho, where it occurs on several habitat types. It is ecologically similar to the more ubiquitous *Ceanothus velutinus*.

Ceanothus velutinus is essentially absent in mature seral and old-growth stages, but often became a stand component after BB or WF treatments in PSME/PHMA dry phase, PSME/VAGL, and occasionally PSME/PHMA moist phase. The species is clearly intolerant of overstory shade and died out by the time the pole stage was reached. Response evidently resulted from heat treatment of seed stored in the surface soil. The species failed to appear after NP and only small amounts resulted from dozer-pile and burn treatments.

Lonicera utahensis is most common in the ABLA/MEFE warm phase. It showed little change after all treatments and was occasionally browsed in the young stands.

Menziesia ferruginea is a major undergrowth component throughout the ABLA/MEFE h.t., and its coverage declined following all treatments except NP, where it remained steady. We found no evidence that BB or WF leads to a MEFE "brushfield" in either phase of ABLA/MEFE h.t. Scarification treatments resulted in marked declines. Following WF, recovery to predisturbance levels appears to require about 30 to 50 years.

Pachistima myrsinites was occasionally common on sites in the ABLA/MEFE warm phase, ABLA/XETE, VAGL phase; and PSME/VAGL h.t. It showed little change after all treatments.

Physocarpus malvaceus is the major shrub in the PSME/PHMA h.t. It decreased somewhat in response to heavy scarification, and a modest decrease was noted after BB on the dry phase. Little change occurred after NP or WF.

Prunus virginiana occasionally became common following BB, WF, or NP treatments on the PSME/PHMA dry phase. It was very scarce in the untreated stands.

Ribes viscosissimum occasionally became common following scarification treatments in the ABLA/MEFE warm phase. It was scarce in untreated stands.

Rubus parviflorus was occasionally common in mature stands in the ABLA/MEFE warm phase, and it often increased modestly after scarification treatments. It showed little change following other treatments.

Salix scouleriana was often a minor component of stands in the PSME/PHMA, PSME/VAGL, and the warm phase of ABLA/MEFE. In PSME/PHMA it increased after all treatments, and the increase was most pronounced following WF. In PSME/VAGL, little change or modest increase was noted after all treatments. In the ABLA/MEFE warm phase, a strong increase was recorded after WF, modest increase after scarification, and generally little change after BB and NP treatments. The larger increases evidently resulted from establishment of wind-transported seed. Once this species becomes well established (in the absence of severe big game browsing) it grows very tall and persists well into the pole stage.

Spiraea betulifolia is a major component of many stands in PSME/PHMA and a minor component of most stands in PSME/VAGL and ABLA/XETE. It increased rather consistently after scarification treatments. After other treatments it showed little change or modest increases.

Symphoricarpos albus is often a major component of stands in the dry phase of PSME/PHMA and is often a minor component in the moist phase. In the dry phase, it generally increased after NP, BB, and MS treatments, but showed little change after WF. In the moist phase, it exhibited little change after NP and MS; there were few data for other treatments.

Vaccinium globulare is a major undergrowth component of most pole-stage or older stands in the PSME/VAGL, ABLA/XETE, VAGL phase, and ABLA/MEFE h.t. It is a minor component of most ABLA/XETE, VASC phase stands. In all habitat type phases, it decreased strongly following scarification treatments and did not recover for about 20 years. On the relatively warm and dry PSME/VAGL h.t., it decreased strongly following all treatments. On ABLA/XETE, VAGL phase, it decreased modestly after NP and strongly after BB and WF, but apparently begins to recover sooner after WF than after scarification. On ABLA/MEFE h.t., it showed little or no decrease after NP and light to moderate BB; it decreased strongly after relatively hot BB and WF, but recovered after about 15 years. After all treatments, a few stunted stems would appear around the edges of rocks or stumps. These evidently were sprouts from surviving rhizomes. As a canopy of saplings developed, this shrub would expand beneath it.

Vaccinium scoparium is a major undergrowth component on the ABLA/MEFE, VASC phase; the ABLA/XETE, VASC phase; and often the ABLA/XETE, VAGL phase. This species had a response similar to that of *Vaccinium globulare*. It decreased strongly after scarification treatments, and less dramatically after most BB, WF, and NP treatments.

Subshrubs

Arctostaphylos uva-ursi is a ground layer associate of CARU and CAGE that was often common on the moist phase of PSME/PHMA and on the PSME/VAGL h.t. It increased strongly after NP and showed little or variable change following other treatments. Its root crown is apparently easily killed by fire or scraping, but any surviving plant parts (and seed regeneration) may allow a rather rapid recovery.

Berberis repens is often a minor associate of stands in the PSME/PHMA, PSME/VAGL, and ABLA/XETE, VAGL phase. It showed little change following treatments, except for occasional decreases after scarification.

Linnaea borealis is occasionally common in the PSME/PHMA moist phase and in the ABLA/MEFE warm phase. Its perenneating organs are near the surface and are evidently vulnerable to fire and scarification (Fischer and Clayton 1983). On PSME/PHMA it generally decreases following all treatments. On ABLA/MEFE it showed variable changes following all treatments.

Graminoids

Calamagrostis rubescens is a major component of the undergrowth in both phases of PSME/PHMA and in PSME/VAGL. It is a minor component in both phases of ABLA/XETE. On the PSME/PHMA moist phase, it showed little change after NP, but decreased after BB and MS. On the dry phase it showed little or variable changes after treatments. On PSME/VAGL it generally increased after NP or light BB, while it was little changed following hot BB or scarification. (It decreased on the youngest WF stand pair, but this was related to development of an extremely dense sapling stand.) Although it is only a minor component in the ABLA/XETE h.t., the species tended to increase strongly after all treatments, except that on the VAGL phase it showed little change after scarification.

Carex geyeri is a major component of many stands in the dry phase of PSME/PHMA and is a common minor component of the PSME/PHMA moist phase, the PSME/VAGL h.t., and the ABLA/XETE h.t. On the PSME/PHMA dry phase it showed a decrease 5 years after BB and WF, and little or variable changes following other treatments. In the other habitat types

and phases, it generally increased after NP, light BB, or scarification. It showed variable changes after hot BB and WF.

Carex rossii is often present in small amounts on untreated stands in the ABLA/XETE and the cold phase of ABLA/MEFE. It increased after all treatments, except occasionally after NP, and it increased strongly after scarification. ***Carex concinnoides*** showed a similar response on both phases of ABLA/XETE h.t.

Forbs

Anaphalis margaritacea is a native species that is rare in mature stands, but colonizes (from wind-transported seed) many of the treated sites in the PSME/VAGL; ABLA/XETE, VAGL phase; and ABLA/MEFE h.t.'s. It becomes common most often following scarification treatments. ***Achillea millefolium*** has a similar response pattern.

Antennaria racemosa is often a minor component of stands on the PSME/PHMA and PSME/VAGL h.t.'s. It showed little change after NP. On the dry phase of PSME/PHMA and on PSME/VAGL, it generally decreased after other treatments, while on the moist phase it showed little change.

Arnica latifolia is often a minor component of the undergrowth on PSME/VAGL and ABLA/XETE, VAGL phase, and it decreased following all stand-removal treatments. It is often a major component of the warm phase of ABLA/MEFE and a minor component of the cold phase. On both phases it showed variable changes following all treatments. It seems to be more tolerant of stand-removing treatments on the ABLA/MEFE h.t., presumably because of moist site conditions.

Aster conspicuus was often a minor component on the PSME/PHMA moist phase and PSME/VAGL h.t. It appeared to increase after NP and showed little change after other treatments.

Chimaphila umbellata, Goodyera oblongifolia, and ***Pyrola secunda*** are small, wintergreen herbs that are widespread in mature stands in these habitat types, but seldom contribute appreciably to undergrowth canopy coverage. All three species essentially disappeared following stand removal treatments, except that some quantity survived after NP. All three species (and probably other wintergreen forbs) return with the development of a new overstory canopy.

Epilobium angustifolium is a wind-seeded native colonizer that became a component of treated stands, other than NP, on the PSME/VAGL h.t. and ABLA/XETE, VAGL phase. It often became a major component on both phases of ABLA/MEFE after scarification, WF, or hot BB.

Fragaria vesca and ***Fragaria virginiana*** form a minor component of the ground cover on PSME/PHMA and PSME/VAGL h.t.'s. They showed little change in response to treatments.

Hedysarum boreale and ***Hedysarum occidentale*** are present in small amounts in a few mature stands in the PSME/VAGL and both phases of ABLA/XETE h.t. These species increased strongly following all treatments in those stands.

Iliamna rivularis is a short-lived seral species that occasionally became well represented after WF or hot BB treatments in the PSME/PHMA dry phase. It evidently regenerated from seed stored in the soil.

Senecio triangularis is a wet-site forb that was often present in small amounts in mature stands in the ABLA/MEFE cold phase. It generally increased with treatments other than NP.

Xerophyllum tenax is a major undergrowth component on the PSME/VAGL, ABLA/XETE, and cold phase of ABLA/MEFE. It is usually a minor component on the warm phase of ABLA/MEFE. On all habitat types, it decreased strongly after scarification and evidently requires 25 years or more to recover. It decreased after WF or relatively hot BB on all habitat types, except the VASC phase of ABLA/XETE, where it showed little change. It showed little or variable change after NP or light BB, except on the ABLA/XETE, VASC phase where it increased, and PSME/VAGL where it decreased. Thus, it was most vulnerable on PSME/VAGL, decreasing after all treatments. In contrast, it was least vulnerable on the ABLA/XETE, VASC phase, where it decreased only after scarification.

REFERENCES

Arno, S. F. The historical role of fire on the Bitterroot National Forest. Research Paper INT-187. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1976. 29 p.

Arno, Stephen F. Forest regions of Montana. Research Paper INT-218. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1979. 39 p.

Arno, S. F. Forest fire history in the Northern Rockies. Journal of Forestry. 78(8): 460-465; 1980.

Arno, S. F.; Sneck (Davis), K. M. A method for determining fire history in coniferous forests of the Mountain West. General Technical Report INT-42. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1977. 28 p.

Cholewa, A. F.; Johnson, F. D. Secondary succession in the *Pseudotsuga menziesii/Physocarpus malvaceus* association. Northwest Science. 57: 273-282; 1983.

Daubenmire, R. A comparison of approaches to the mapping of forest land for intensive management. Forestry Chronicle. 49(2): 87-91; 1973.

Fiedler, C. E. Regeneration of clearcuts in four habitat types in western Montana. In: Baumgartner, D. M., ed. Site preparation and fuels management on steep terrain: symposium proceedings; 1982 February 15-17; Spokane, WA. Pullman, WA: Washington State University, Cooperative Extension; 1982: 139-147.

Fischer, W. C.; Clayton, B. D. Fire ecology of Montana forest habitat types east of the Continental Divide. General Technical Report INT-141. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1983. 83 p.

Gruell, George E.; Schmidt, Wyman C.; Arno, Stephen F.; Reich, William J. Seventy years of vegetal change in a managed ponderosa pine forest in western Montana—implications for resource management. General Technical Report INT-130. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1982. 42 p.

Hann, W. J. A taxonomy for classification of seral vegetation of selected habitat types in western Montana. Moscow, ID: University of Idaho; 1982. 235 p. Ph.D. dissertation.

Keane, R. E. Evaluation of a successional classification system. Unpublished cooperative report on file at: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, Northern Forest Fire Laboratory, Drawer G, Missoula, MT; 1983. 25 p.

Lyon, L. J.; Stickney, P. F. Early vegetal succession following large northern Rocky Mountain wildfires. Proceedings, Tall Timbers Fire Ecology Conference. 14: 355-375; 1976.

Mueller-Dombois, D.; Ellenberg, H. Aims and methods of vegetation ecology. New York: John Wiley and Sons; 1974. 547 p.

Nimlos, T. J. Zonal great soil groups in western Montana. Montana Academy of Science Proceedings. 23: 3-13; 1963.

Pfister, R. D.; Kovalchik, B. L.; Arno, S. F.; Presby, R. C. Forest habitat types of Montana. General Technical Report INT-34. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1977. 174 p.

Pfister, R. E.; Arno, S. F. Classifying forest habitat types based on potential climax vegetation. Forest Science. 26(1): 52-70; 1980.

Steele, R. An approach to classifying seral vegetation within habitat types. Northwest Science. 58: 29-39; 1984.

Stickney, P. F. Data base for post-fire succession, first 6 to 9 years, in Montana larch-fir forests. General Technical Report INT-62. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1980. 133 p.

Stickney, P. F. First decade plant succession following the Sundance Forest Fire, northern Idaho. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; [in preparation].

Thomas, J. W., tech. ed. Wildlife habitats in managed forests: the Blue Mountains of Oregon and Washington. Agriculture Handbook 553. Washington, DC: U.S. Department of Agriculture, Forest Service; 1979. 512 p.

U.S. Department of Agriculture, Soil Conservation Service. Soil taxonomy. Agriculture Handbook 436. Washington, DC: U.S. Department of Agriculture, Forest Service; 1975. 754 p.

Volland, L. A.; Dell, J. D. Fire effects on Pacific Northwest forest and range vegetation. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region; 1981. 23 p.

Zamora, B. A. Secondary succession on broadcast-burned clearcuts of the *Abies grandis-Pachistima myrsinites* habitat type in north-central Idaho. Pullman, WA: Washington State University; 1975. 117 p. Ph.D dissertation.

APPENDIX A-1.—CONSTANCY* AND AVERAGE CANOPY COVERAGE (PERCENT) OF IMPORTANT PLANTS IN EACH COMMUNITY TYPE OF THE PSME/PHMA, DRY PHASE

(Abbreviated scientific names of plants are listed below; full names are listed in appendix B.)

STRUCTUAL STAGE	SHRUB-HERB				SAPLING				POLE			MATURE SERAL FOREST			
Community Type	PHMA	PHMA-CARU	PHMA-AMAL	CEVE-PHMA	PSME/PHMA	PSME/PHMA-CARU	PSME/PHMA-AMAL	PSME/CEVE-PHMA	PSME/PHMA	PSME/PHMA-CARU	PSME/PHMA-AMAL	PSME/PHMA	PSME/PHMA-CARU	PSME/PHMA-AMAL	PSME-PIPO/PHMA-
Number of Plots	13	20	13	17	2	12	7	6	6	7	10	4	8	5	15
TREE SPECIES ********															
6 LAROCC	1(T)	+(T)	2(T)	-( )	-( )	-( )	1(T)	-( )	2(T)	3(3)	2(T)	-( )	1(T)	10(1)	1(8)
10 PINCON	-( )	2(T)	2(T)	2(5)	-( )	4(2)	1(63)	2(T)	2(T)	4(14)	3(3)	2(T)	1(3)	4(T)	-( )
13 PINPON	7(2)	5(4)	7(3)	5(T)	10(20)	7(26)	9(24)	10(18)	10(3)	7(15)	8(11)	10(1)	6(T)	10(1)	10(26)
14 POPTRE	2(T)	2(4)	-( )	1(T)	5(T)	3(1)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
16 PSEMEN	7(2)	9(5)	8(7)	8(T)	10(9)	10(30)	10(27)	10(27)	10(70)	10(65)	10(64)	10(44)	10(62)	10(48)	10(30)
SHRUB SPECIES ********															
102 ACEGLA	6(1)	3(1)	7(8)	3(7)	5(3)	1(T)	6(8)	3(9)	7(T)	4(2)	7(20)	10(5)	5(5)	10(9)	1(3)
105 AMEALN	10(5)	8(4)	10(20)	9(5)	10(8)	6(T)	10(14)	10(16)	7(5)	10(6)	10(16)	7(2)	10(4)	10(36)	10(4)
198 CEASAN	-( )	+(T)	2(8)	-( )	-( )	-( )	-( )	2(15)	-( )	-( )	-( )	-( )	-( )	-( )	-( )
107 CEAVEL	2(1)	2(T)	4(2)	10(41)	-( )	-( )	-( )	10(54)	-( )	4(1)	5(T)	-( )	2(2)	-( )	1(T)
111 HOLDIS	-( )	1(2)	2(15)	2(10)	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	1(T)	4(19)	-( )
115 LONUTA	3(T)	3(1)	4(2)	3(T)	-( )	4(4)	4(1)	-( )	-( )	-( )	2(8)	5(T)	2(T)	6(T)	1(T)
119 PHILEW	1(T)	-( )	-( )	1(8)	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
122 PHYMAL	10(46)	10(37)	9(26)	10(23)	10(39)	10(17)	10(12)	10(28)	10(38)	10(32)	10(38)	10(62)	10(41)	6(31)	10(45)
123 PRUEMA	-( )	+(T)	1(3)	1(3)	-( )	-( )	-( )	-( )	-( )	1(T)	1(T)	-( )	-( )	-( )	1(T)
124 PRUVIR	2(T)	1(2)	4(7)	3(2)	-( )	-( )	-( )	3(T)	2(T)	1(3)	2(8)	2(T)	2(T)	-( )	2(T)
125 PURTRI	-( )	-( )	2(6)	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(T)
128 RIBCER	1(T)	+(3)	-( )	-( )	-( )	6(T)	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )
130 RIBLAC	-( )	1(T)	1(3)	1(T)	-( )	3(2)	1(T)	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )
131 RIBVIS	2(T)	2(7)	3(8)	5(2)	10(2)	8(1)	1(15)	3(T)	-( )	1(T)	1(T)	2(T)	1(T)	4(T)	1(T)
132 ROSACI	2(1)	2(T)	2(1)	3(4)	-( )	4(T)	3(T)	3(T)	3(2)	-( )	-( )	-( )	-( )	4(T)	1(T)
133 ROSGYM	2(1)	3(T)	6(3)	4(T)	5(3)	3(1)	6(T)	5(T)	-( )	3(2)	7(T)	2(T)	1(T)	10(9)	1(T)
134 ROSWOO	1(T)	+(T)	-( )	1(T)	-( )	-( )	1(T)	2(T)	-( )	-( )	-( )	2(T)	-( )	-( )	1(T)
136 RUBPAR	-( )	1(1)	3(1)	2(T)	5(T)	2(T)	3(9)	2(T)	-( )	-( )	2(T)	-( )	-( )	6(T)	-( )
137 SALSCO	5(T)	5(1)	6(15)	7(4)	10(3)	6(4)	10(15)	3(3)	2(T)	3(3)	7(8)	2(T)	2(T)	6(1)	1(T)
164 SAMCER	-( )	1(T)	1(T)	-( )	-( )	-( )	-( )	2(T)	2(T)	1(T)	2(T)	-( )	1(T)	-( )	-( )
139 SHECAN	-( )	+(T)	3(1)	1(T)	5(T)	4(T)	4(T)	-( )	-( )	-( )	-( )	2(T)	-( )	2(T)	1(T)
142 SPIBET	9(17)	7(11)	10(10)	10(8)	10(2)	10(12)	10(10)	7(5)	7(5)	7(8)	8(3)	10(19)	6(2)	10(17)	7(5)
143 SYMALB	8(15)	8(12)	9(10)	8(10)	10(20)	9(14)	10(13)	7(8)	8(4)	7(14)	9(5)	5(9)	5(12)	10(9)	9(10)
163 SYMORE	2(5)	1(2)	2(2)	2(5)	-( )	2(1)	-( )	2(T)	2(3)	-( )	-( )	2(3)	-( )	-( )	1(T)
146 VACGLO	2(3)	2(5)	5(11)	3(T)	-( )	3(4)	4(5)	2(T)	2(3)	1(T)	1(3)	-( )	1(3)	6(T)	-( )
SUBSHRUB SPECIES *******															
201 ARCUVA	2(T)	4(5)	5(T)	2(8)	10(8)	8(15)	9(3)	8(1)	2(T)	3(2)	2(T)	2(3)	1(3)	4(T)	3(1)
203 BERREP	6(T)	7(1)	8(3)	8(1)	-( )	6(7)	3(T)	7(5)	8(7)	7(7)	8(T)	7(T)	9(2)	8(T)	7(2)
204 CLECOL	3(T)	2(1)	2(T)	1(T)	-( )	2(1)	1(T)	-( )	2(T)	-( )	4(T)	5(T)	2(T)	8(T)	2(T)
206 LINBOR	2(2)	1(3)	4(8)	-( )	5(T)	3(12)	1(3)	-( )	-( )	-( )	2(T)	-( )	-( )	6(T)	1(15)
GRAMINOIDS ************															
301 AGRSPI	2(T)	2(7)	4(9)	2(8)	-( )	2(T)	1(T)	3(2)	-( )	1(3)	3(T)	7(T)	6(12)	-( )	3(5)
303 BROCAR	1(T)	2(2)	1(T)	2(T)	-( )	-( )	-( )	3(T)	2(T)	4(T)	-( )	-( )	4(T)	2(T)	-( )
307 CALRUB	9(6)	9(33)	9(16)	9(11)	10(15)	10(40)	10(20)	10(9)	10(7)	10(26)	9(13)	5(9)	10(26)	10(38)	9(46)
308 CARCON	5(T)	5(2)	6(1)	3(T)	-( )	7(T)	6(5)	3(2)	-( )	3(2)	1(3)	5(T)	4(1)	8(T)	1(T)
309 CARGEY	9(6)	9(19)	8(15)	10(11)	10(3)	10(9)	9(21)	10(26)	7(5)	7(26)	9(29)	10(1)	10(41)	8(2)	9(23)
311 CARROS	3(T)	2(1)	2(1)	4(T)	-( )	-( )	-( )	-( )	-( )	1(T)	3(T)	-( )	1(T)	2(T)	1(T)

316 ELYGLA	1(3)	+(T)	2(T)	-( )	-( )	-( )	-( )	3(T)	2(T)	-( )	1(T)	-( )	1(3)	2(T)	1(T)
317 FESIDA	1(T)	2(T)	3(5)	1(T)	-( )	-( )	-( )	-( )	-( )	1(3)	1(T)	-( )	1(T)	-( )	1(T)
318 FESOCC	3(T)	1(1)	2(T)	1(T)	-( )	1(T)	1(3)	-( )	-( )	3(T)	4(T)	2(T)	7(T)	4(T)	1(T)
319 FESSCA	2(2)	1(T)	1(T)	2(1)	-( )	1(T)	1(T)	-( )	-( )	1(3)	-( )	-( )	-( )	-( )	2(1)
396 POACOM	-( )	+(3)	-( )	-( )	-( )	-( )	1(3)	2(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )
331 POANER	-( )	2(5)	-( )	-( )	5(T)	2(T)	-( )	-( )	-( )	1(T)	-( )	2(T)	1(T)	-( )	2(T)
PERENNIAL FORBS	*******														
401 ACHMIL	8(T)	7(T)	5(1)	7(T)	5(T)	7(2)	7(T)	7(1)	2(T)	7(T)	2(T)	-( )	7(T)	-( )	7(T)
404 ALLCER	4(T)	2(T)	2(T)	1(T)	-( )	-( )	3(T)	2(T)	2(T)	6(T)	2(T)	2(T)	2(T)	-( )	6(T)
405 ANAMAR	-( )	-( )	2(2)	2(1)	5(T)	-( )	-( )	2(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )
414 ANTMIC	1(T)	+(T)	1(T)	1(T)	5(T)	3(T)	1(T)	2(T)	-( )	1(T)	1(T)	-( )	1(T)	-( )	1(T)
413 ANTRAC	6(2)	8(3)	4(T)	2(T)	10(3)	7(5)	9(T)	2(T)	2(T)	4(5)	3(5)	-( )	7(3)	8(T)	7(4)
415 APOAND	-( )	1(T)	3(8)	2(1)	-( )	-( )	1(T)	2(T)	-( )	-( )	1(T)	-( )	-( )	-( )	1(T)
421 ARNCOR	5(T)	4(1)	2(T)	2(T)	5(3)	6(2)	4(T)	2(T)	7(2)	6(1)	1(3)	7(1)	1(3)	4(T)	3(2)
422 ARNLAT	3(1)	3(3)	5(4)	2(1)	10(3)	9(1)	3(2)	2(T)	5(T)	3(9)	-( )	-( )	-( )	-( )	-( )
426 ASTCON	5(4)	7(9)	6(2)	4(3)	5(38)	9(14)	6(4)	5(2)	-( )	10(3)	5(T)	2(T)	4(T)	10(T)	5(T)
428 ASTLAE	-( )	1(T)	2(T)	1(T)	-( )	1(T)	3(T)	5(T)	2(T)	1(T)	-( )	-( )	-( )	4(T)	1(T)
429 ASTCAN	-( )	-( )	-( )	1(15)	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
431 BALSAG	1(T)	3(10)	4(2)	3(T)	5(T)	1(T)	1(T)	3(T)	3(T)	4(1)	5(T)	5(T)	6(1)	-( )	5(5)
436 CAMROT	1(T)	-( )	1(T)	1(T)	-( )	-( )	-( )	3(T)	-( )	3(T)	2(T)	-( )	1(T)	-( )	1(T)
438 CASMIN	-( )	2(1)	2(T)	2(T)	-( )	4(T)	1(T)	-( )	2(T)	-( )	-( )	-( )	-( )	-( )	1(T)
442 CHIUMB	-( )	+(T)	-( )	-( )	-( )	-( )	4(T)	-( )	-( )	1(T)	-( )	2(T)	-( )	6(T)	-( )
597 CIRUND	-( )	2(1)	-( )	1(3)	-( )	2(T)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
455 DISTRA	1(T)	1(T)	2(T)	-( )	-( )	1(T)	1(T)	-( )	2(T)	1(T)	3(T)	5(2)	1(T)	6(T)	2(T)
459 EPIANG	5(3)	6(1)	5(2)	5(2)	5(3)	7(3)	6(T)	5(1)	-( )	-( )	2(T)	5(T)	1(T)	2(T)	-( )
464 ERYGRA	3(T)	2(T)	2(T)	2(T)	-( )	5(T)	3(T)	2(T)	5(T)	1(T)	6(T)	2(T)	6(T)	-( )	5(T)
465 FRAVES	7(1)	8(4)	9(2)	6(3)	10(3)	10(9)	7(2)	8(2)	7(T)	9(1)	7(T)	7(T)	10(1)	10(T)	8(1)
466 FRAVIR	5(3)	7(T)	6(T)	6(1)	-( )	3(T)	4(1)	10(T)	7(T)	6(1)	8(T)	5(T)	7(T)	8(T)	6(1)
476 GOOOBL	-( )	-( )	-( )	-( )	-( )	1(T)	3(T)	-( )	5(T)	1(T)	3(1)	2(T)	4(T)	8(T)	2(T)
482 HEUCYL	2(T)	3(T)	2(T)	1(T)	-( )	-( )	3(T)	-( )	-( )	3(T)	1(T)	-( )	4(T)	-( )	3(T)
483 HIEALB	2(T)	2(T)	2(T)	4(T)	5(T)	2(1)	3(T)	3(T)	7(T)	3(T)	2(T)	2(T)	1(T)	-( )	2(T)
833 ILLRIV	2(5)	+(T)	2(9)	1(3)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
495 LITRUD	-( )	3(T)	2(T)	1(T)	5(T)	2(T)	-( )	3(T)	-( )	-( )	1(T)	-( )	2(T)	-( )	2(T)
499 LUPINU	2(T)	4(2)	1(3)	1(T)	5(3)	4(1)	1(T)	2(T)	2(T)	3(T)	1(T)	-( )	5(4)	2(T)	7(4)
502 MITSTA	2(2)	+(T)	1(T)	2(T)	-( )	-( )	1(T)	-( )	2(T)	1(T)	1(T)	2(T)	2(T)	-( )	1(T)
505 OSMCHI	1(3)	-( )	-( )	-( )	-( )	-( )	1(T)	2(T)	3(T)	1(T)	1(T)	-( )	1(T)	4(T)	1(T)
508 PEDCON	-( )	1(T)	1(T)	-( )	-( )	6(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
510 PENALB	4(2)	6(1)	4(1)	5(3)	10(T)	7(1)	6(1)	-( )	-( )	1(3)	1(T)	-( )	-( )	-( )	1(T)
659 PENCAE	2(T)	3(T)	2(T)	2(T)	-( )	-( )	1(T)	7(T)	2(T)	4(T)	3(T)	-( )	5(T)	-( )	6(T)
514 PENWIL	-( )	+(T)	-( )	2(T)	-( )	-( )	-( )	-( )	2(T)	-( )	-( )	2(T)	-( )	-( )	-( )
522 POTGLA	1(3)	2(1)	-( )	1(2)	-( )	2(T)	1(T)	-( )	2(T)	-( )	-( )	-( )	1(T)	-( )	-( )
529 PYRSEC	-( )	-( )	-( )	-( )	-( )	2(T)	3(T)	-( )	-( )	-( )	-( )	-( )	-( )	2(T)	-( )
535 SEDSTE	1(T)	2(T)	2(T)	1(T)	-( )	3(T)	3(T)	-( )	-( )	3(T)	-( )	-( )	5(T)	-( )	1(T)
542 SMIRAC	5(T)	4(T)	7(T)	1(T)	-( )	2(1)	3(T)	2(T)	7(1)	3(T)	5(T)	7(T)	4(T)	4(T)	3(T)
543 SMISTE	-( )	-( )	2(T)	-( )	-( )	-( )	1(T)	-( )	2(T)	1(T)	2(T)	-( )	-( )	4(T)	1(T)
544 SOLMIS	1(T)	1(T)	-( )	-( )	-( )	1(3)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
547 THAOCC	5(T)	5(4)	6(T)	2(T)	-( )	4(6)	3(T)	5(T)	-( )	6(2)	6(T)	2(3)	5(1)	10(1)	3(T)
560 TRIOVA	-( )	-( )	2(T)	-( )	-( )	1(3)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )

****

* CODE TO CONSTANCY VALUES

+ = 0-5%	2 = 15-25%	4 = 35-45%	6 = 55-65%	8 = 75-85%	10 = 95-100%
1 = 5-15%	3 = 25-35%	5 = 45-55%	7 = 65-75%	9 = 85-95%	

(CANOPY COVERAGE EXPRESSED TO NEAREST %)

APPENDIX A-2.—CONSTANCY* AND AVERAGE CANOPY COVERAGE (PERCENT) OF IMPORTANT PLANTS IN EACH COMMUNITY TYPE OF THE PSME/PHMA, MOIST PHASE

(Abbreviated scientific names of plants are listed below; full names are listed in appendix B.)

STRUCTURAL STAGE	SHRUB-HERB				SAPLING				POLE			MATURE SERAL FOREST	
Community Type	PHMA-CARU	PHMA-AMAL	CEVE-PHMA	CESA-PHMA	PSME/PHMA-CARU	PSME-LAOC/PHMA-CARU	PSME-LAOC/PHMA-AMAL	PSME-LAOC/CEVE-PHMA	PSME/PHMA-CARU	PSME-LAOC/PHMA-CARU	PSME-LAOC/PHMA-AMAL	PSME/PHMA-CARU	PSME-LAOC/PHMA-CARU
Number of Plots	14	11	7	7	4	3	5	6	2	3	6	2	9
TREE SPECIES ********													
1 ABIGRA	1(T)	1(T)	-( )	-( )	-( )	3(T)	-( )	-( )	-( )	-( )	2(T)	-( )	1(T)
6 LAROCC	9(1)	6(1)	7(3)	3(T)	10(5)	10(23)	10(24)	8(3)	10(3)	10(38)	8(29)	10(2)	10(30)
10 PINCON	2(T)	4(T)	4(T)	3(T)	-( )	7(9)	6(2)	5(T)	-( )	-( )	7(32)	5(T)	2(2)
13 PINPON	7(4)	4(2)	7(6)	3(2)	10(10)	10(2)	6(T)	10(34)	5(15)	7(8)	5(5)	10(2)	9(1)
16 PSEMEN	9(3)	9(2)	10(3)	10(1)	10(40)	10(26)	10(29)	10(8)	10(63)	10(47)	10(39)	10(50)	10(26)
SHRUB SPECIES ********													
102 ACEGLA	6(1)	7(14)	7(8)	10(6)	5(T)	7(T)	10(6)	8(3)	5(T)	-( )	8(10)	-( )	6(1)
105 AMEALN	10(6)	9(14)	10(4)	10(7)	10(9)	10(2)	10(10)	10(8)	5(15)	10(2)	10(12)	10(8)	10(3)
198 CEASAN	-( )	-( )	1(T)	10(45)	-( )	-( )	-( )	2(3)	-( )	-( )	-( )	-( )	-( )
107 CEAVEL	4(2)	3(1)	10(35)	9(7)	5(2)	7(2)	2(T)	10(46)	-( )	-( )	-( )	-( )	-( )
111 HOLDIS	1(3)	3(10)	4(5)	7(2)	2(T)	-( )	4(T)	8(10)	-( )	3(15)	-( )	-( )	-( )
115 LONUTA	4(2)	6(T)	3(T)	1(T)	10(1)	-( )	4(T)	5(T)	10(T)	-( )	8(1)	10(T)	7(T)
118 PACMYR	3(1)	3(T)	4(T)	3(T)	-( )	3(T)	-( )	2(T)	5(T)	-( )	2(T)	-( )	-( )
122 PHYMAL	10(31)	10(28)	10(21)	10(21)	10(38)	10(25)	10(20)	10(6)	10(50)	10(23)	10(23)	10(9)	10(38)
130 RIBLAC	1(T)	3(1)	1(T)	-( )	-( )	3(T)	2(T)	-( )	-( )	-( )	-( )	-( )	2(T)
131 RIBVIS	6(3)	4(6)	6(4)	3(T)	7(5)	7(19)	2(T)	2(T)	10(T)	-( )	-( )	-( )	1(T)
132 ROSACI	2(T)	2(T)	1(3)	7(1)	2(T)	7(T)	2(T)	2(T)	5(T)	-( )	-( )	-( )	1(3)
133 ROSGYM	6(T)	4(1)	6(T)	4(1)	7(T)	3(T)	6(1)	7(T)	5(T)	7(2)	8(3)	10(2)	10(3)
136 RUBPAR	6(T)	5(4)	3(8)	4(T)	5(T)	3(T)	4(2)	3(T)	-( )	-( )	2(T)	5(T)	1(T)
137 SALSCO	6(2)	9(7)	6(9)	9(4)	7(5)	10(1)	10(8)	10(9)	-( )	-( )	7(8)	-( )	4(1)
139 SHECAN	1(2)	4(2)	3(T)	1(3)	-( )	-( )	8(4)	7(2)	-( )	-( )	-( )	10(2)	1(T)
142 SPIBET	9(8)	10(6)	10(13)	10(31)	10(15)	10(19)	10(14)	10(13)	10(2)	10(7)	10(2)	10(33)	10(8)
143 SYMALB	9(4)	10(2)	6(1)	10(5)	10(2)	7(33)	8(5)	8(1)	10(2)	10(19)	7(5)	5(T)	10(3)
146 VACGLO	5(3)	5(3)	1(T)	4(T)	7(5)	3(T)	6(6)	5(T)	-( )	3(T)	3(T)	10(8)	6(6)
SUBSHRUB SPECIES *******													
201 ARCUVA	9(7)	7(9)	6(5)	7(2)	7(5)	7(3)	6(5)	8(14)	-( )	10(T)	3(3)	10(19)	7(4)
203 BERREP	8(2)	5(2)	7(2)	10(3)	10(2)	7(T)	10(4)	10(11)	10(2)	7(2)	8(1)	10(2)	9(1)
204 CLECOL	4(T)	3(T)	1(T)	-( )	5(T)	3(3)	-( )	-( )	10(T)	3(T)	2(T)	5(T)	3(2)
206 LINBOR	3(2)	5(10)	-( )	-( )	-( )	-( )	6(1)	-( )	-( )	3(T)	7(14)	10(2)	6(11)
207 LONCIL	1(T)	-( )	1(T)	-( )	-( )	-( )	-( )	5(6)	-( )	-( )	2(15)	5(T)	1(T)
FERNS AND ALLIES *******													
271 POLAND	1(3)	-( )	-( )	-( )	2(T)	-( )	-( )	-( )	-( )	-( )	3(8)	-( )	-( )
GRAMINOIDS ************													
301 AGRSPI	-( )	1(T)	-( )	4(2)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
303 BROCAR	1(8)	1(T)	-( )	-( )	-( )	3(T)	4(T)	-( )	-( )	-( )	2(T)	-( )	-( )
307 CALRUB	10(33)	10(23)	10(16)	10(28)	10(26)	10(46)	10(15)	10(26)	10(50)	10(54)	10(26)	10(50)	10(40)
308 CARCON	6(T)	5(8)	1(3)	4(1)	2(T)	7(T)	6(T)	5(T)	5(T)	7(T)	2(T)	10(T)	7(T)
309 CARGEY	9(12)	8(6)	7(6)	10(4)	10(10)	10(1)	6(26)	10(3)	10(2)	7(T)	5(1)	10(2)	8(12)
373 DACGLO	1(15)	1(3)	-( )	-( )	-( )	3(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )
318 FESOCC	4(T)	4(2)	1(T)	4(6)	-( )	3(T)	8(T)	2(T)	5(T)	3(3)	-( )	5(T)	9(T)
334 TRISPI	1(3)	-( )	-( )	-( )	5(T)	-( )	2(T)	-( )	-( )	-( )	-( )	5(T)	2(2)

PERENNIAL FORBS *******													
401 ACHMIL	9(T)	8(1)	6(2)	6(1)	7(T)	7(T)	4(T)	8(2)	-( )	7(T)	-( )	-( )	3(T)
404 ALLCER	2(T)	2(T)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	3(T)	-( )	5(T)	1(T)
405 ANAMAR	4(T)	4(T)	4(T)	9(T)	-( )	3(T)	2(T)	2(T)	-( )	-( )	-( )	-( )	-( )
409 ANTANA	-( )	-( )	3(T)	4(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
413 ANTRAC	6(3)	5(3)	6(1)	3(T)	10(5)	10(5)	4(2)	2(T)	10(2)	7(T)	2(T)	10(T)	10(3)
415 APOAND	1(3)	-( )	4(6)	6(12)	-( )	3(T)	-( )	7(2)	-( )	-( )	-( )	-( )	-( )
421 ARNCOR	3(T)	4(1)	1(T)	-( )	-( )	-( )	4(T)	3(T)	5(3)	7(9)	5(6)	5(T)	2(2)
422 ARNLAT	4(1)	7(3)	4(T)	3(T)	2(15)	-( )	2(T)	8(T)	5(T)	7(2)	3(19)	5(15)	3(1)
426 ASTCON	8(4)	6(4)	4(2)	6(T)	7(2)	7(T)	10(2)	8(7)	10(8)	7(T)	8(T)	10(T)	9(1)
428 ASTLAE	1(T)	2(T)	-( )	1(T)	2(T)	-( )	-( )	-( )	5(T)	-( )	-( )	-( )	2(T)
429 ASTCAN	2(2)	4(6)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
430 ASTMIS	1(T)	3(T)	-( )	-( )	-( )	-( )	4(T)	2(T)	-( )	-( )	2(T)	5(3)	2(T)
436 CAMROT	1(T)	1(T)	-( )	7(T)	5(T)	-( )	-( )	7(T)	-( )	3(T)	-( )	-( )	1(T)
438 CASMIN	2(1)	4(5)	1(T)	-( )	2(3)	-( )	2(T)	3(T)	-( )	-( )	-( )	-( )	2(T)
442 CHIUMB	1(T)	2(T)	-( )	-( )	2(T)	-( )	6(T)	-( )	-( )	-( )	8(1)	10(T)	3(T)
455 DISTRA	2(T)	2(T)	-( )	-( )	2(T)	-( )	-( )	-( )	5(T)	-( )	2(T)	5(T)	3(T)
459 EPIANG	9(4)	8(2)	6(T)	9(2)	5(2)	7(19)	6(T)	7(T)	-( )	-( )	-( )	5(T)	3(T)
464 ERYGRA	1(T)	2(T)	3(T)	-( )	-( )	-( )	2(T)	3(T)	10(T)	3(T)	3(T)	5(T)	8(T)
465 FRAVES	8(3)	7(5)	3(T)	1(T)	10(5)	7(T)	10(1)	10(8)	5(T)	10(T)	3(T)	5(T)	10(T)
466 FRAVIR	7(2)	9(2)	6(T)	4(T)	7(2)	3(T)	6(T)	3(T)	10(2)	10(1)	8(T)	10(T)	8(T)
471 GALTRI	1(T)	2(T)	-( )	-( )	-( )	-( )	4(T)	-( )	-( )	-( )	-( )	-( )	-( )
476 GOOOBL	1(T)	-( )	-( )	-( )	2(T)	-( )	6(T)	-( )	5(T)	7(T)	3(T)	5(T)	8(T)
478 HABELE	1(T)	1(T)	1(T)	-( )	-( )	-( )	-( )	2(T)	-( )	-( )	-( )	-( )	-( )
480 HEDOCC	1(T)	2(3)	1(T)	-( )	-( )	-( )	2(3)	2(T)	-( )	-( )	-( )	5(T)	-( )
482 HEUCYL	4(1)	5(1)	1(T)	3(T)	2(T)	3(T)	2(T)	-( )	-( )	3(T)	-( )	-( )	1(T)
483 HIEALB	2(T)	6(T)	6(T)	1(T)	2(T)	3(T)	6(T)	8(T)	-( )	-( )	2(T)	-( )	-( )
484 HIEALF	1(T)	1(T)	-( )	-( )	-( )	3(T)	-( )	-( )	-( )	7(T)	2(T)	10(T)	2(T)
499 LUPINU	2(T)	3(T)	-( )	-( )	5(2)	-( )	4(T)	-( )	5(T)	3(T)	-( )	-( )	3(1)
502 MITSTA	3(2)	2(T)	-( )	-( )	5(T)	-( )	2(T)	-( )	5(T)	3(T)	-( )	-( )	3(T)
510 PENALB	3(1)	5(T)	7(2)	3(T)	5(T)	-( )	4(T)	10(T)	-( )	-( )	-( )	-( )	2(T)
659 PENCAE	1(T)	-( )	-( )	-( )	2(T)	3(T)	2(T)	-( )	-( )	3(T)	-( )	-( )	-( )
514 PENWIL	1(T)	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	5(T)	-( )
526 PYRASA	-( )	2(8)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
529 PYRSEC	-( )	2(T)	-( )	-( )	-( )	-( )	2(T)	-( )	-( )	-( )	3(T)	-( )	2(T)
535 SEDSTE	1(3)	2(2)	4(T)	-( )	2(T)	-( )	-( )	2(T)	-( )	-( )	-( )	-( )	-( )
542 SMIRAC	6(T)	6(T)	4(T)	3(T)	2(T)	3(T)	10(T)	7(T)	5(T)	-( )	5(1)	10(T)	7(T)
543 SMISTE	3(T)	4(T)	-( )	-( )	-( )	-( )	6(1)	5(T)	-( )	-( )	2(T)	5(T)	-( )
544 SOLMIS	2(T)	1(T)	1(T)	6(1)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
547 THAOCC	6(T)	3(T)	1(T)	1(T)	2(15)	-( )	10(1)	2(T)	5(T)	10(1)	3(T)	5(T)	6(1)
550 VALDIO	3(1)	1(T)	-( )	-( )	2(T)	3(T)	-( )	-( )	-( )	-( )	2(T)	-( )	4(T)
558 XERTEN	5(5)	4(5)	4(5)	1(T)	5(8)	3(3)	4(15)	5(2)	5(15)	3(T)	5(T)	5(T)	3(1)
ANNUALS **************													
904 EPIPAN	1(2)	3(T)	1(T)	1(15)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
906 MELLIN	1(T)	-( )	-( )	1(3)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )

****
****

* CODE TO CONSTANCY VALUES

+ = 0-5%	2 = 15-25%	4 = 35-45%	6 = 55-65%	8 = 75-85%	10 = 95-100%
1 = 5-15%	3 = 25-35%	5 = 45-55%	7 = 65-75%	9 = 85-95%	

(CANOPY COVERAGE EXPRESSED TO NEAREST %)

APPENDIX A-3.—CONSTANCY* AND AVERAGE CANOPY COVERAGE (PERCENT) OF IMPORTANT PLANTS IN EACH COMMUNITY TYPE OF THE PSME/VAGL, XETE PHASE

(Abbreviated scientific names of plants are listed below; full names are listed in appendix B.)

STRUCTURAL STAGE	SHRUB-HERB				SAPLING				POLE		MATURE	OLD GROWTH
Community Type	VAGL-CARU	XETE-CARU	CARU	CEVE	PICO PSME/ VAGL-CARU	PICO/ XETE-CARU	PICO/ DEPAU-PERATE	PICO-PSMF/ CEVE	PICO-PSME/ VAGL-CARU	PICO-PSME/ VAGL-ARLA	PSME-PICO/ VAGL-CARU	PSME/ VAGL-CARU
Number of Plots	22	7	10	12	18	2	2	11	10	3	9	15
TREE SPECIES ********												
1 ABIGRA	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(3)
2 ABILAS	2(T)	-( )	1(T)	1(T)	2(T)	5(T)	-( )	4(1)	2(T)	7(2)	6(T)	5(3)
6 LAROCC	4(4)	1(T)	-( )	2(T)	3(11)	-( )	5(T)	5(12)	6(12)	-( )	1(T)	5(19)
9 PINALB	-( )	1(T)	-( )	-( )	-( )	5(T)	-( )	1(T)	-( )	3(T)	4(1)	1(T)
10 PINCON	9(6)	4(T)	9(T)	8(8)	9(29)	10(15)	10(85)	10(23)	8(36)	10(50)	10(32)	8(3)
13 PINPON	5(7)	-( )	3(1)	4(2)	4(19)	-( )	-( )	4(10)	6(15)	7(8)	3(5)	4(16)
14 POPTRE	2(1)	1(T)	-( )	2(T)	3(T)	-( )	-( )	3(T)	-( )	-( )	-( )	-( )
16 PSEMEN	10(5)	9(4)	10(1)	10(5)	8(13)	10(19)	5(T)	10(5)	10(28)	10(34)	10(31)	10(40)
SHRUB SPECIES ********												
102 ACEGLA	2(3)	1(T)	2(T)	7(1)	1(T)	-( )	-( )	4(4)	2(T)	7(T)	2(T)	1(T)
104 ALNSIN	3(T)	-( )	1(T)	1(T)	3(T)	-( )	-( )	2(T)	-( )	-( )	-( )	1(T)
105 AMEALN	7(4)	6(15)	6(2)	8(7)	6(7)	5(T)	-( )	5(5)	9(1)	7(2)	7(1)	7(1)
107 CEAVEL	4(2)	4(1)	5(2)	10(40)	3(1)	5(T)	-( )	10(43)	2(8)	-( )	1(T)	2(13)
111 HOLDIS	-( )	-( )	-( )	2(2)	-( )	-( )	-( )	1(3)	-( )	-( )	-( )	-( )
115 LONUTA	6(2)	6(1)	5(2)	3(T)	4(2)	5(T)	-( )	5(T)	2(T)	3(T)	4(T)	5(T)
118 PACMYR	2(T)	-( )	-( )	1(15)	1(T)	-( )	-( )	3(7)	3(10)	-( )	2(3)	1(15)
130 RIBLAC	3(T)	-( )	-( )	-( )	1(T)	-( )	5(T)	-( )	1(T)	3(T)	1(T)	1(T)
131 RIBVIS	8(3)	7(7)	8(3)	5(3)	6(4)	10(2)	-( )	5(3)	2(2)	3(T)	1(T)	3(T)
132 ROSACI	1(T)	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(2)
133 ROSGYM	6(T)	3(T)	3(T)	6(T)	4(1)	5(3)	10(T)	2(T)	6(6)	7(T)	6(T)	5(1)
136 RUBPAR	3(T)	3(T)	1(T)	2(1)	1(T)	-( )	-( )	3(5)	1(T)	3(T)	1(T)	-( )
137 SALSCO	8(6)	4(T)	5(4)	8(2)	9(6)	10(T)	5(T)	8(5)	9(6)	10(1)	6(T)	3(T)
139 SHECAN	2(2)	-( )	-( )	2(T)	2(T)	-( )	-( )	2(8)	-( )	7(2)	3(1)	2(T)
140 SORSCO	1(T)	1(T)	-( )	1(T)	-( )	-( )	-( )	-( )	1(T)	3(T)	1(T)	2(T)
142 SPIBET	10(8)	6(2)	9(6)	10(11)	9(9)	10(2)	10(3)	9(6)	8(8)	10(6)	9(3)	9(2)
143 SYMALB	6(2)	1(15)	5(4)	8(2)	3(3)	5(T)	-( )	4(1)	2(T)	3(T)	2(T)	-( )
163 SYMORE	2(4)	3(3)	3(1)	2(2)	-( )	-( )	-( )	3(T)	-( )	-( )	-( )	2(1)
146 VACGLO	10(23)	9(2)	8(1)	10(14)	10(24)	10(3)	10(2)	9(19)	10(32)	10(62)	10(50)	10(40)
148 VACSCO	1(T)	3(T)	2(T)	-( )	3(4)	5(3)	5(3)	1(T)	2(T)	-( )	2(32)	1(3)
SUBSHRUB SPECIES *******												
201 ARCUVA	5(6)	1(38)	4(5)	5(7)	7(17)	-( )	5(T)	7(5)	6(4)	3(T)	4(5)	5(8)
203 BERREP	5(T)	9(3)	9(T)	7(1)	5(2)	-( )	-( )	6(2)	9(3)	10(T)	9(T)	9(T)
206 LINBOR	3(T)	-( )	-( )	-( )	2(T)	-( )	-( )	2(T)	1(T)	-( )	2(T)	1(2)
FERNS AND ALLIES *******												
271 POLAND	+(3)	-( )	-( )	-( )	1(2)	-( )	5(15)	1(15)	-( )	-( )	-( )	-( )
259 PTEAQU	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	1(15)	-( )	-( )	-( )
GRAMINOIDS ************												
303 BROCAR	+(T)	3(T)	3(2)	1(3)	1(T)	-( )	-( )	1(T)	-( )	-( )	-( )	-( )
307 CALRUB	10(27)	10(33)	10(52)	10(24)	10(34)	10(26)	10(9)	10(28)	10(38)	10(11)	10(17)	10(32)
308 CARCON	5(3)	6(4)	6(T)	2(T)	7(2)	10(T)	5(T)	6(2)	8(1)	10(T)	8(T)	7(T)
309 CARGEY	8(8)	9(21)	10(16)	10(11)	9(7)	10(8)	-( )	8(5)	5(7)	10(5)	9(3)	9(5)
311 CARROS	4(T)	3(T)	3(T)	2(T)	1(T)	5(T)	5(T)	4(T)	-( )	-( )	4(T)	2(T)
316 ELYGLA	-( )	1(T)	-( )	1(3)	-( )	-( )	-( )	-( )	2(T)	-( )	-( )	-( )
318 FESOCC	1(2)	-( )	1(T)	1(T)	-( )	-( )	5(T)	1(3)	-( )	-( )	1(T)	3(1)

PERENNIAL FORBS *******												
401 ACHMIL	6(T)	7(T)	10(T)	6(T)	6(T)	10(T)	5(T)	4(1)	2(T)	3(T)	1(T)	1(T)
404 ALLCER	-( )	-( )	1(T)	-( )	1(T)	-( )	-( )	1(3)	1(T)	-( )	-( )	-( )
405 ANAMAR	3(T)	1(T)	2(T)	1(T)	4(T)	5(T)	-( )	4(1)	-( )	-( )	-( )	-( )
414 ANTMIC	+(T)	-( )	3(T)	-( )	1(T)	5(T)	5(T)	-( )	-( )	-( )	-( )	-( )
413 ANTRAC	6(3)	1(T)	4(T)	4(2)	3(1)	5(T)	-( )	3(T)	4(1)	3(T)	7(2)	7(3)
415 APOAND	+(T)	3(T)	1(T)	1(T)	1(T)	-( )	-( )	-( )	1(T)	3(T)	2(T)	1(T)
419 ARECON	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(8)
578 ARELAT	1(T)	-( )	-( )	1(T)	1(T)	-( )	-( )	-( )	1(T)	-( )	-( )	1(3)
421 ARNCOR	+(T)	3(T)	2(T)	2(T)	1(T)	5(T)	5(T)	2(2)	5(5)	7(2)	3(1)	6(6)
422 ARNLAT	8(3)	4(1)	3(T)	7(3)	9(6)	10(2)	10(32)	6(1)	5(T)	10(34)	6(21)	3(4)
426 ASTCON	4(5)	7(10)	7(9)	5(3)	4(11)	-( )	5(T)	5(1)	1(T)	7(T)	3(T)	5(3)
429 ASTCAN	-( )	1(15)	-( )	-( )	1(8)	-( )	-( )	-( )	-( )	-( )	-( )	-( )
430 ASTMIS	1(T)	-( )	1(T)	-( )	1(3)	-( )	-( )	1(T)	1(T)	3(T)	2(T)	1(2)
438 CASMIN	2(T)	3(T)	2(3)	1(T)	3(2)	-( )	-( )	2(T)	3(T)	-( )	-( )	1(T)
441 CHIMEN	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	2(T)	3(T)	1(T)	1(T)
442 CHIUMB	3(T)	-( )	-( )	-( )	1(2)	-( )	5(3)	3(T)	9(1)	7(2)	9(3)	7(1)
597 CIRUND	1(T)	-( )	4(T)	-( )	-( )	5(T)	-( )	-( )	-( )	-( )	-( )	-( )
459 EPIANG	8(3)	9(3)	8(T)	7(T)	7(T)	10(T)	5(T)	7(T)	7(T)	7(T)	2(T)	3(T)
464 ERYGRA	2(T)	3(8)	-( )	4(T)	3(T)	5(3)	5(3)	-( )	1(T)	-( )	1(T)	1(T)
465 FRAVES	5(1)	7(2)	5(2)	4(3)	5(6)	-( )	-( )	7(2)	5(T)	7(T)	3(T)	3(2)
466 FRAVIR	3(2)	4(T)	4(2)	3(T)	3(4)	-( )	-( )	3(1)	4(T)	-( )	2(2)	5(T)
474 GEUTRI	-( )	-( )	-( )	-( )	1(2)	-( )	-( )	-( )	-( )	-( )	-( )	-( )
476 GOOOBL	1(T)	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	2(T)	7(T)	8(T)	7(T)
478 HABELE	+(T)	1(T)	-( )	1(T)	-( )	-( )	-( )	-( )	1(T)	-( )	1(T)	1(T)
819 HEDBOR	-( )	1(T)	1(15)	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	1(T)
480 HEDOCC	1(T)	1(T)	-( )	-( )	1(T)	5(3)	-( )	1(3)	-( )	7(T)	2(T)	1(T)
483 HIEALB	3(T)	7(T)	5(T)	5(T)	4(T)	5(T)	-( )	5(T)	5(1)	3(T)	2(T)	3(T)
484 HIEALF	2(T)	3(T)	4(T)	1(T)	2(T)	-( )	-( )	1(T)	3(T)	7(T)	8(T)	9(T)
499 LUPINU	1(T)	7(1)	3(5)	-( )	3(3)	-( )	-( )	1(T)	1(T)	3(T)	4(2)	3(17)
502 MITSTA	1(8)	-( )	-( )	1(T)	-( )	-( )	5(T)	-( )	-( )	-( )	-( )	-( )
505 OSMCHI	1(1)	-( )	2(T)	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	1(T)	3(T)
507 PEDBRA	1(T)	-( )	-( )	1(T)	1(T)	-( )	-( )	1(T)	1(T)	3(T)	2(T)	4(T)
508 PEDCON	3(3)	-( )	-( )	1(T)	3(1)	-( )	-( )	1(T)	2(T)	-( )	2(T)	3(T)
509 PEDRAC	1(2)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	3(T)	3(1)	5(T)
510 PENALB	6(T)	4(T)	7(T)	3(1)	4(T)	-( )	-( )	4(T)	2(T)	-( )	1(T)	1(T)
659 PENCAE	1(2)	1(T)	3(T)	1(T)	1(T)	5(T)	-( )	2(2)	-( )	3(T)	1(T)	3(T)
522 POTGLA	1(1)	1(T)	3(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
528 PYRPIC	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	1(T)	3(T)	4(T)	1(T)
529 PYRSEC	1(T)	-( )	-( )	-( )	1(T)	-( )	5(T)	1(T)	4(T)	7(T)	8(T)	6(T)
535 SEDSTE	-( )	-( )	3(1)	-( )	-( )	-( )	-( )	1(3)	-( )	-( )	1(T)	1(T)
541 SILMEN	-( )	1(T)	1(T)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	2(T)
542 SMIRAC	1(T)	3(T)	1(T)	2(T)	1(T)	-( )	-( )	1(T)	-( )	-( )	-( )	3(T)
547 THAOCC	3(T)	9(T)	3(1)	4(2)	1(T)	5(T)	5(T)	2(2)	1(T)	7(2)	3(1)	4(5)
550 VALDIO	-( )	1(T)	3(T)	2(T)	1(3)	-( )	-( )	-( )	-( )	-( )	1(T)	1(T)
558 XERTEN	10(15)	10(39)	10(2)	10(11)	10(18)	10(26)	10(T)	10(19)	10(21)	10(27)	10(29)	10(38)
ANNUALS **************												
902 COLPAR	+(T)	1(T)	3(T)	2(T)	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	1(T)
904 EPIPAN	1(T)	1(T)	6(T)	2(T)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	1(T)
906 MELLIN	1(2)	-( )	-( )	-( )	2(5)	-( )	-( )	2(T)	2(2)	7(T)	6(2)	1(2)

****
****

* CODE TO CONSTANCY VALUES

+ = 0-5%	2 = 15-25%	4 = 35-45%	6 = 55-65%	8 = 75-85%	10 = 95-100%
1 = 5-15%	3 = 25-35%	5 = 45-55%	7 = 65-75%	9 = 85-95%	

(CANOPY COVERAGE EXPRESSED TO NEAREST %)

APPENDIX A-4.—CONSTANCY* AND AVERAGE CANOPY COVERAGE (PERCENT) OF IMPORTANT PLANTS IN EACH COMMUNITY TYPE OF THE ABLA/XETE, VAGL PHASE

(Abbreviated scientific names of plants are listed below; full names are listed in appendix B.)

STRUCTURAL STAGE	SHRUB-HERB						SAPLING			POLE	MATURE	OLD GROWTH
Community Type	PICO/ VAGL- XETE	VAGL- XETE	XETE- CARU	CARU	PICO/ DEPAU PERATE	EPAN	PICO/ VAGL- XETE	PICO/ XETE- CARU	PICO/ CARU	PICO/ VAGL- XETE	PICO- PSME/ VAGL- XETE	ABLA- PSME/ VAGL- XETE
Number of Plots	8	27	12	2	2	6	24	3	1	17	14	9
TREE SPECIES ********												
2 ABILAS	7(6)	8(2)	7(2)	5(T)	10(2)	3(2)	5(5)	3(T)	10(T)	8(3)	10(16)	9(44)
6 LAROCC	1(63)	2(T)	2(T)	-( )	-( )	3(3)	3(9)	10(14)	-( )	5(9)	2(1)	7(6)
7 PICENG	4(6)	3(T)	2(T)	5(T)	10(2)	5(T)	3(3)	-( )	-( )	2(1)	5(7)	7(4)
9 PINALB	-( )	1(T)	2(T)	5(T)	-( )	-( )	1(T)	-( )	10(T)	1(T)	6(3)	6(5)
10 PINCON	9(33)	7(3)	8(3)	5(T)	10(39)	10(3)	9(35)	10(31)	10(38)	10(59)	10(17)	8(5)
16 PSEMEN	6(7)	7(3)	8(1)	10(T)	10(T)	3(T)	8(4)	7(2)	10(T)	9(16)	8(20)	8(29)
SHRUB SPECIES ********												
102 ACEGLA	1(15)	3(3)	-( )	5(T)	5(T)	2(3)	-( )	-( )	-( )	-( )	1(T)	2(8)
104 ALNSIN	2(T)	2(2)	1(T)	-( )	5(T)	2(T)	2(T)	7(T)	-( )	1(T)	1(T)	1(T)
105 AMEALN	4(6)	5(6)	2(2)	10(2)	-( )	2(T)	4(2)	3(T)	-( )	-( )	2(T)	4(1)
107 CEAVEL	-( )	2(T)	2(2)	10(T)	-( )	2(T)	2(2)	7(T)	-( )	-( )	-( )	-( )
115 LONUTA	4(5)	4(2)	4(3)	5(T)	-( )	2(T)	2(2)	-( )	-( )	1(T)	-( )	3(T)
116 MENFER	1(T)	2(T)	-( )	-( )	-( )	-( )	+(T)	-( )	-( )	2(T)	2(T)	2(T)
118 PACMYR	-( )	2(5)	2(8)	-( )	-( )	3(9)	3(5)	3(38)	-( )	2(8)	1(2)	2(9)
130 RIBLAC	4(T)	2(T)	2(1)	5(T)	-( )	2(T)	2(1)	-( )	-( )	1(T)	1(T)	2(T)
131 RIBVIS	2(2)	5(9)	7(2)	10(T)	-( )	5(T)	5(T)	3(3)	-( )	1(T)	1(T)	2(T)
133 ROSGYM	6(1)	3(1)	2(T)	-( )	-( )	2(T)	2(1)	-( )	-( )	1(T)	1(T)	2(T)
136 RUBPAR	2(8)	1(T)	2(T)	5(T)	-( )	2(T)	1(T)	3(T)	-( )	1(T)	-( )	-( )
137 SALSCO	9(10)	7(4)	3(10)	-( )	-( )	7(1)	7(9)	10(3)	10(T)	6(2)	3(T)	-( )
139 SHECAN	-( )	1(1)	-( )	5(T)	-( )	-( )	1(T)	3(T)	-( )	-( )	1(T)	1(3)
140 SORSCO	-( )	1(2)	1(T)	5(T)	-( )	-( )	-( )	-( )	-( )	1(T)	1(T)	2(T)
142 SPIBET	9(15)	7(5)	7(5)	5(15)	-( )	7(1)	8(5)	10(7)	10(T)	8(2)	7(T)	4(1)
163 SYMORE	1(T)	2(4)	-( )	-( )	-( )	-( )	1(2)	-( )	-( )	-( )	-( )	-( )
146 VACGLO	10(24)	10(23)	9(3)	5(3)	10(T)	10(9)	10(32)	10(3)	10(3)	10(40)	10(43)	10(38)
147 VACMYR	-( )	+(3)	-( )	-( )	-( )	-( )	+(T)	-( )	-( )	1(8)	-( )	1(15)
148 VACSCO	7(4)	4(5)	8(2)	-( )	10(T)	3(32)	5(11)	10(5)	10(3)	6(27)	9(23)	3(26)
SUBSHRUB SPECIES *******												
201 ARCUVA	1(3)	1(T)	2(T)	-( )	-( )	-( )	2(4)	7(9)	10(T)	2(1)	-( )	2(2)
203 BERREP	1(3)	2(T)	4(T)	10(2)	-( )	3(T)	2(T)	-( )	-( )	2(1)	3(T)	4(T)
206 LINBOR	1(T)	1(2)	-( )	-( )	-( )	-( )	+(T)	-( )	-( )	1(T)	-( )	1(T)
FERNS AND ALLIES *******												
271 POLAND	-( )	+(3)	-( )	-( )	-( )	2(3)	1(2)	3(15)	-( )	1(T)	-( )	-( )
GRAMINOIDS ************												
303 BROCAR	-( )	+(T)	1(T)	10(2)	5(T)	-( )	+(T)	-( )	-( )	1(T)	-( )	1(T)
306 CALPUR	-( )	-( )	1(3)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(3)	-( )
307 CALRUB	10(21)	8(14)	10(21)	5(T)	-( )	5(5)	8(11)	10(10)	10(38)	8(7)	6(5)	6(T)
308 CARCON	4(7)	6(3)	7(3)	5(T)	5(T)	8(2)	7(4)	7(3)	10(T)	6(1)	7(T)	6(1)
309 CARGEY	9(7)	9(10)	9(18)	10(26)	10(T)	7(5)	7(4)	10(7)	10(T)	7(T)	9(2)	8(6)
311 CARROS	7(T)	7(2)	7(3)	5(3)	10(9)	8(3)	5(1)	7(T)	10(T)	1(T)	4(T)	2(T)

316 ELYGLA	-( )	+(T)	2(2)	10(T)	-( )	-( )	+(T)	-( )	-( )	-( )	1(T)	1(3)
318 FESOCC	-( )	2(2)	2(T)	5(T)	-( )	-( )	+(T)	3(3)	-( )	1(T)	1(3)	2(T)
325 LUZHIT	-( )	1(T)	-( )	-( )	5(T)	-( )	+(T)	-( )	-( )	1(T)	1(T)	-( )
334 TRISPI	-( )	+(T)	-( )	-( )	5(3)	-( )	+(T)	-( )	-( )	-( )	-( )	-( )
PERENNIAL FORBS *******												
401 ACHMIL	1(T)	4(T)	7(T)	10(T)	5(3)	2(T)	2(1)	7(8)	-( )	-( )	1(T)	-( )
405 ANAMAR	5(1)	4(5)	7(T)	5(3)	10(8)	10(8)	3(3)	10(1)	10(T)	1(T)	-( )	-( )
414 ANTMIC	2(T)	1(T)	2(T)	-( )	5(T)	-( )	1(T)	3(T)	10(T)	-( )	-( )	-( )
413 ANTRAC	2(2)	5(2)	4(3)	10(T)	5(T)	-( )	2(T)	-( )	-( )	2(1)	2(1)	3(T)
421 ARNCOR	2(T)	-( )	1(3)	-( )	-( )	-( )	+(T)	-( )	-( )	-( )	-( )	-( )
422 ARNLAT	9(5)	10(5)	7(1)	5(T)	10(T)	5(13)	8(5)	7(8)	10(T)	8(12)	9(6)	9(12)
426 ASTCON	2(3)	2(4)	3(8)	5(T)	-( )	3(8)	1(7)	-( )	-( )	2(T)	1(T)	1(3)
427 ASTFOL	-( )	-( )	1(15)	5(3)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	1(3)
429 ASTCAN	-( )	-( )	-( )	-( )	-( )	-( )	+(3)	-( )	-( )	-( )	-( )	-( )
430 ASTMIS	1(T)	+(T)	-( )	-( )	-( )	-( )	1(2)	-( )	-( )	1(T)	1(T)	1(T)
438 CASMIN	-( )	+(T)	-( )	5(T)	-( )	-( )	1(5)	-( )	-( )	-( )	1(T)	1(T)
441 CHIMEN	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	1(T)	3(T)
442 CHIUMB	1(T)	1(T)	2(T)	-( )	-( )	3(T)	3(3)	3(T)	-( )	8(4)	9(T)	10(1)
597 CIRUND	1(T)	-( )	-( )	-( )	-( )	2(15)	-( )	7(2)	-( )	-( )	-( )	-( )
447 CLIUNI	-( )	+(T)	-( )	-( )	-( )	2(T)	-( )	-( )	-( )	-( )	-( )	1(3)
459 EPIANG	9(3)	8(1)	9(4)	10(T)	5(T)	10(35)	7(2)	10(1)	10(T)	3(T)	3(T)	1(T)
464 ERYGRA	1(T)	2(T)	-( )	-( )	-( )	-( )	+(T)	-( )	-( )	1(T)	1(T)	-( )
465 FRAVES	1(3)	3(2)	3(1)	-( )	-( )	2(15)	2(2)	3(3)	-( )	1(T)	-( )	1(T)
466 FRAVIR	1(T)	3(T)	4(1)	10(3)	-( )	-( )	1(T)	-( )	-( )	1(T)	1(T)	-( )
476 GOOOBL	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	4(T)	5(T)	8(T)
480 HEDOCC	-( )	+(T)	1(T)	-( )	-( )	2(T)	3(8)	7(9)	-( )	-( )	2(5)	-( )
630 HEDSUL	-( )	+(T)	-( )	5(3)	-( )	-( )	-( )	3(T)	-( )	1(T)	1(T)	-( )
483 HIEALB	7(T)	3(T)	2(T)	5(T)	5(T)	3(T)	4(T)	7(2)	-( )	4(T)	1(T)	-( )
484 HIEALF	-( )	3(T)	5(T)	5(T)	10(T)	3(T)	2(T)	-( )	10(T)	4(T)	8(T)	6(T)
833 ILLRIV	-( )	-( )	-( )	5(3)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
499 LUPINU	2(T)	5(T)	5(T)	5(T)	10(8)	-( )	2(2)	-( )	-( )	3(T)	4(T)	2(8)
502 MITSTA	-( )	1(2)	1(T)	-( )	-( )	2(T)	+(T)	-( )	-( )	1(T)	-( )	1(T)
505 OSMCHI	-( )	1(T)	-( )	-( )	-( )	-( )	+(T)	-( )	-( )	1(T)	1(T)	1(T)
506 OSMOCC	-( )	-( )	1(T)	5(T)	-( )	-( )	+(T)	-( )	-( )	-( )	1(T)	1(T)
507 PEDBRA	-( )	1(2)	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	4(T)	4(T)	2(T)
508 PEDCON	-( )	1(T)	1(T)	-( )	-( )	-( )	2(T)	-( )	10(T)	1(T)	3(1)	-( )
509 PEDRAC	-( )	1(T)	1(T)	-( )	-( )	-( )	1(T)	-( )	10(T)	4(T)	4(3)	3(T)
510 PENALB	1(T)	3(T)	2(T)	5(T)	-( )	2(T)	2(T)	10(T)	-( )	-( )	-( )	-( )
513 PENPRO	-( )	+(T)	1(3)	-( )	-( )	-( )	+(T)	-( )	10(T)	1(T)	-( )	-( )
529 PYRSEC	-( )	1(T)	-( )	-( )	-( )	-( )	2(T)	-( )	-( )	4(T)	4(T)	9(T)
531 PYRVIR	-( )	-( )	-( )	-( )	-( )	-( )	+(T)	-( )	-( )	1(T)	1(T)	1(T)
542 SMIRAC	1(T)	1(T)	1(T)	-( )	-( )	-( )	+(T)	-( )	-( )	1(T)	-( )	1(T)
547 THAOCC	1(T)	4(1)	3(5)	5(T)	-( )	-( )	1(2)	-( )	-( )	1(T)	3(1)	4(8)
551 VALSIT	-( )	2(T)	3(1)	5(T)	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	2(T)
557 VIOORB	1(T)	1(T)	-( )	-( )	-( )	2(T)	1(T)	-( )	-( )	3(T)	4(T)	2(T)
558 XERTEN	10(29)	10(28)	10(32)	10(3)	5(T)	10(9)	10(29)	10(30)	10(T)	10(35)	10(52)	10(45)
ANNUALS **************												
904 EPIPAN	1(T)	1(T)	3(T)	10(T)	-( )	2(T)	+(T)	-( )	-( )	-( )	-( )	-( )
906 MELLIN	-( )	-( )	-( )	-( )	-( )	2(T)	1(T)	3(3)	-( )	1(T)	1(T)	-( )

****
****

* CODE TO CONSTANCY VALUES

+ = 0-5%	2 = 15-25%	4 = 35-45%	6 = 55-65%	8 = 75-85%	10 = 95-100%
1 = 5-15%	3 = 25-35%	5 = 45-55%	7 = 65-75%	9 = 85-95%	

(CANOPY COVERAGE EXPRESSED TO NEAREST %)

APPENDIX A-5.—CONSTANCY* AND AVERAGE CANOPY COVERAGE (PERCENT) OF IMPORTANT PLANTS IN EACH COMMUNITY TYPE OF THE ABLA/XETE, VASC PHASE

(Abbreviated scientific names of plants are listed below; full names are listed in appendix B.)

STRUCTURAL STAGE	SHRUB-HERB				SAPLING				POLE	MATURE		OLD GROWTH
Community Type	PICO/ VASC- XETE	VASC- XETE	XETE- CARU	PICO/ EPAN- VASC	PICO/ VASC- XETE	PICO/ XETE- CARU	PICO/ CARU	PICO/ DEPAU- PERATE	PICO/ VASC- XETE	PICO- ABLA/ VASC- XETE	PICO/ VASC- XETE	ABLA/ DEPAU- PERATE
Number of Plots	6	11	3	2	34	3	2	1	6	3	5	1
TREE SPECIES ********												
2 ABILAS	7(4)	8(6)	-( )	10(8)	7(5)	10(5)	5(T)	-( )	7(4)	10(23)	8(T)	10(63)
6 LAROCC	2(T)	1(T)	3(T)	-( )	-( )	-( )	-( )	-( )	2(T)	-( )	-( )	-( )
7 PICENG	2(T)	2(2)	-( )	-( )	4(1)	3(T)	5(T)	-( )	2(3)	3(15)	2(T)	10(3)
9 PINALB	3(T)	4(1)	-( )	-( )	5(T)	3(T)	5(T)	-( )	2(T)	10(5)	6(T)	10(3)
10 PINCON	10(27)	10(8)	10(2)	10(26)	10(43)	7(15)	10(15)	10(85)	10(70)	10(15)	10(43)	10(3)
13 PINPON	-( )	1(T)	-( )	-( )	-( )	3(38)	-( )	-( )	-( )	-( )	-( )	-( )
16 PSEMEN	2(T)	2(T)	-( )	-( )	4(3)	3(T)	5(T)	-( )	5(T)	3(15)	8(T)	10(3)
SHRUB SPECIES ********												
115 LONUTA	2(T)	1(T)	-( )	-( )	2(3)	-( )	10(T)	-( )	2(3)	-( )	2(T)	-( )
133 ROSGYM	2(15)	1(T)	-( )	-( )	+(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )
137 SALSCO	2(3)	5(T)	3(T)	-( )	6(T)	3(T)	10(T)	10(T)	-( )	-( )	4(2)	-( )
142 SPIBET	10(6)	6(3)	3(T)	10(T)	9(3)	7(2)	5(3)	10(15)	5(1)	10(T)	8(T)	-( )
146 VACGLO	10(14)	9(11)	7(T)	10(15)	8(5)	7(T)	-( )	10(3)	10(14)	7(2)	10(1)	-( )
148 VACSCO	10(30)	10(36)	10(3)	10(15)	10(48)	10(3)	10(2)	10(3)	10(46)	10(70)	10(48)	-( )
SUBSHRUB SPECIES *******												
201 ARCUVA	3(T)	-( )	3(3)	-( )	2(2)	7(2)	5(T)	-( )	-( )	-( )	4(T)	-( )
203 BERREP	-( )	1(T)	-( )	-( )	+(T)	3(T)	5(T)	-( )	-( )	-( )	2(T)	-( )
GRAMINOIDS ************												
303 BROCAR	-( )	1(T)	-( )	-( )	1(5)	3(T)	5(T)	-( )	2(T)	-( )	-( )	-( )
307 CALRUB	8(29)	8(10)	10(5)	10(8)	8(14)	10(15)	10(20)	10(3)	5(2)	-( )	8(2)	-( )
308 CARCON	8(2)	5(5)	10(5)	10(9)	6(1)	7(2)	5(3)	-( )	3(8)	7(T)	8(T)	-( )
309 CARGEY	7(T)	7(8)	10(30)	10(15)	6(8)	7(15)	5(15)	10(T)	5(T)	7(T)	6(2)	-( )
311 CARROS	8(7)	7(8)	10(10)	10(9)	9(3)	10(6)	10(8)	10(T)	3(T)	3(T)	4(T)	-( )
318 FESOCC	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	2(15)	-( )	2(T)	-( )
334 TRISPI	-( )	1(T)	-( )	-( )	2(T)	3(T)	5(3)	-( )	-( )	-( )	-( )	-( )
PERENNIAL FORBS *******												
401 ACHMIL	2(T)	1(T)	3(T)	-( )	2(T)	3(T)	-( )	10(T)	2(T)	-( )	-( )	-( )
405 ANAMAR	7(2)	5(2)	3(T)	10(2)	3(T)	7(T)	-( )	-( )	2(T)	-( )	-( )	-( )
414 ANTMIC	2(T)	1(T)	-( )	-( )	+(T)	7(T)	-( )	-( )	2(T)	-( )	-( )	-( )
413 ANTRAC	-( )	-( )	3(T)	-( )	2(T)	-( )	-( )	-( )	3(T)	-( )	2(T)	-( )
422 ARNLAT	7(1)	9(1)	7(T)	10(2)	8(7)	10(1)	10(T)	-( )	10(6)	7(T)	6(7)	10(T)
426 ASTCON	2(T)	3(10)	-( )	-( )	1(1)	-( )	-( )	-( )	-( )	-( )	-( )	-( )
430 ASTMIS	-( )	-( )	-( )	-( )	1(T)	-( )	5(T)	-( )	2(T)	3(T)	2(T)	-( )
442 CHIUMB	-( )	1(T)	3(T)	-( )	3(T)	-( )	-( )	-( )	7(1)	3(T)	10(3)	10(T)
608 EPIALP	-( )	-( )	3(T)	5(T)	+(T)	3(T)	5(T)	-( )	-( )	-( )	-( )	-( )
459 EPIANG	7(1)	8(7)	7(9)	10(26)	7(T)	7(T)	10(T)	10(T)	2(15)	-( )	-( )	-( )
465 FRAVES	-( )	2(3)	-( )	-( )	1(T)	-( )	5(T)	-( )	-( )	-( )	-( )	-( )
476 GOOOBL	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	3(T)	6(T)	10(T)

480 HEDOCC	2(T)	-( )	3(T)	-( )	3(10)	7(15)	5(T)	-( )	2(15)	3(3)	2(T)	-( )
483 HIEALB	10(T)	5(2)	7(T)	10(2)	3(T)	3(T)	5(T)	-( )	2(T)	-( )	-( )	-( )
484 HIEALF	-( )	1(T)	3(T)	-( )	1(T)	-( )	5(T)	-( )	2(T)	7(T)	6(T)	10(T)
499 LUPINU	7(T)	5(T)	3(3)	5(T)	3(1)	3(T)	5(T)	-( )	5(T)	-( )	2(T)	-( )
509 PEDRAC	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	2(T)	3(T)	6(T)	-( )
510 PENALB	2(T)	-( )	3(T)	-( )	1(T)	7(T)	5(T)	-( )	-( )	-( )	-( )	-( )
526 PYRASA	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	10(T)
528 PYRPIC	-( )	1(T)	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	2(T)	-( )
529 PYRSEC	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	2(T)	3(T)	2(T)	10(T)
531 PYRVIR	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	2(T)	10(T)
557 VIOORB	-( )	2(8)	3(T)	-( )	+(T)	-( )	-( )	-( )	3(2)	-( )	2(T)	10(T)
558 XERTEN	10(27)	8(29)	10(23)	10(38)	10(24)	10(23)	10(2)	10(3)	10(28)	10(26)	10(26)	10(T)
ANNUALS **************												
906 MELLIN	2(T)	-( )	3(T)	-( )	1(3)	-( )	5(T)	-( )	-( )	-( )	2(T)	-( )

****
****

* CODE TO CONSTANCY VALUES

+ = 0-5%	2 = 15-25%	4 = 35-45%	6 = 55-65%	8 = 75-85%	10 = 95-100%
1 = 5-15%	3 = 25-35%	5 = 45-55%	7 = 65-75%	9 = 85-95%	

(CANOPY COVERAGE EXPRESSED TO NEAREST %)

APPENDIX A-6.—CONSTANCY* AND AVERAGE CANOPY COVERAGE (PERCENT) OF IMPORTANT PLANTS IN EACH COMMUNITY TYPE OF THE ABLA/MEFE, WARM PHASE

(Abbreviated scientific names of plants are listed below; full names are listed in appendix B.)

STRUCTURAL STAGE	SHRUB-HERB							SAPLING					POLE		MATURE	OLD GROWTH
Community Type	MEFE-VAGL	EPAN-MEFE	VAGL	EPAN	SASC	RIVI	ARLA	ABLA/MEFE-VAGL	ABLA-(OTHERS)/MEFE-EPAN	5SPP/VAGL	5SPP/EPAN	5SPP/SASC	ABLA-(OTHERS)/MEFE-VAGL	5SPP/MEFE-VAGL	5SPP/MEFE-VAGL	ABLA-(OTHERS)/MEFE-VAGL
Number of Plots	15	11	15	12	2	3	5	11	4	13	2	4	1	7	13	6
TREE SPECIES	********															
2 ABILAS	10(6)	9(8)	9(2)	10(1)	10(T)	7(2)	8(T)	10(24)	10(8)	9(6)	10(2)	10(T)	10(38)	10(15)	10(12)	10(28)
6 LAROCC	3(T)	5(T)	5(1)	3(1)	10(T)	-( )	6(1)	5(26)	10(12)	7(18)	10(15)	5(38)	10(15)	6(11)	6(15)	8(13)
7 PICENG	6(1)	9(2)	7(T)	10(1)	5(T)	10(1)	6(T)	7(7)	10(4)	8(2)	10(T)	10(8)	-( )	7(27)	10(13)	10(12)
9 PINALB	-( )	2(T)	2(T)	1(T)	-( )	-( )	-( )	-( )	-( )	2(1)	-( )	-( )	-( )	-( )	-( )	2(T)
10 PINCON	5(2)	7(3)	9(5)	8(6)	10(2)	7(2)	6(1)	7(3)	7(18)	8(16)	10(15)	10(15)	10(15)	9(32)	10(15)	5(2)
13 PINPON	1(T)	1(T)	3(4)	2(1)	-( )	3(15)	-( )	3(23)	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )
14 POPTRE	3(T)	2(T)	3(1)	2(T)	-( )	10(1)	4(2)	1(T)	7(T)	2(5)	5(T)	2(3)	-( )	-( )	-( )	-( )
15 POPTRI	2(1)	4(T)	3(1)	5(T)	5(T)	7(T)	6(T)	1(T)	5(T)	3(T)	-( )	-( )	-( )	-( )	-( )	-( )
16 PSEMEN	9(1)	8(4)	8(4)	7(T)	5(T)	10(1)	6(T)	10(6)	7(10)	8(4)	10(9)	10(5)	10(T)	10(20)	8(14)	7(5)
SHRUB SPECIES	********															
102 ACEGLA	2(T)	1(T)	2(1)	-( )	-( )	-( )	-( )	5(4)	2(3)	2(T)	-( )	5(T)	10(T)	-( )	2(2)	-( )
104 ALNSIN	7(7)	5(5)	8(7)	8(3)	10(T)	7(T)	8(2)	6(9)	7(6)	8(9)	10(15)	7(6)	10(T)	9(4)	9(2)	7(4)
105 AMEALN	3(1)	5(T)	6(3)	-( )	-( )	3(T)	2(T)	7(3)	2(T)	2(T)	-( )	2(T)	10(3)	1(T)	2(T)	-( )
107 CEAVEL	1(2)	2(T)	2(T)	1(T)	-( )	7(T)	2(T)	1(T)	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )
115 LONUTA	7(3)	7(T)	6(4)	3(2)	5(3)	3(T)	6(1)	5(5)	7(5)	5(4)	-( )	2(15)	10(3)	3(2)	8(3)	2(T)
116 MENFER	10(37)	10(17)	10(2)	7(2)	10(2)	10(1)	10(2)	10(21)	10(21)	9(2)	10(2)	10(1)	10(15)	10(21)	10(24)	10(36)
118 PACMYR	1(3)	3(7)	3(3)	3(1)	10(2)	-( )	-( )	2(9)	5(15)	1(T)	10(9)	2(15)	10(15)	4(15)	-( )	3(T)
130 RIBLAC	7(1)	7(3)	7(1)	6(4)	-( )	7(8)	8(1)	5(3)	10(4)	6(T)	10(T)	5(2)	-( )	3(2)	5(T)	3(T)
131 RIBVIS	4(1)	5(6)	6(9)	3(1)	5(T)	10(31)	4(2)	6(3)	5(T)	8(4)	10(2)	7(13)	-( )	3(T)	2(T)	2(T)
133 ROSGYM	3(1)	-( )	3(T)	-( )	5(T)	-( )	4(T)	5(1)	-( )	2(T)	5(T)	-( )	10(T)	3(2)	3(T)	-( )
135 RUBIDA	-( )	1(T)	1(T)	2(T)	-( )	7(2)	2(3)	-( )	-( )	2(T)	-( )	2(T)	-( )	-( )	-( )	-( )
136 RUBPAR	7(2)	8(3)	8(2)	5(2)	5(T)	10(6)	8(2)	9(2)	7(T)	9(5)	10(9)	10(2)	10(3)	6(T)	8(5)	7(1)
137 SALSCO	6(8)	8(9)	9(9)	7(3)	10(38)	10(3)	10(1)	7(10)	10(1)	8(8)	10(2)	10(33)	10(T)	9(3)	5(T)	-( )
138 SAMRAC	2(5)	5(2)	5(3)	7(T)	-( )	10(5)	8(1)	2(T)	5(T)	5(T)	5(T)	5(T)	-( )	-( )	2(T)	2(T)
139 SHECAN	1(T)	-( )	1(T)	-( )	5(T)	-( )	-( )	1(3)	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )
140 SORSCO	2(T)	-( )	1(T)	1(T)	-( )	-( )	-( )	1(T)	-( )	2(T)	-( )	-( )	-( )	-( )	-( )	-( )
142 SPIBET	6(3)	6(4)	9(4)	3(1)	5(3)	3(T)	2(3)	7(5)	5(T)	8(3)	10(T)	5(2)	10(15)	3(2)	3(T)	2(T)
144 TAXBRE	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	2(T)	-( )	1(T)	1(T)	2(3)
146 VACGLO	10(21)	9(11)	10(20)	9(3)	10(2)	7(2)	8(1)	10(25)	10(18)	10(36)	10(3)	10(2)	10(15)	10(17)	9(37)	8(19)
148 VACSCO	3(4)	4(8)	3(13)	2(8)	5(3)	-( )	2(3)	1(.3)	7(10)	3(10)	-( )	-( )	10(15)	3(19)	2(T)	3(T)
SUBSHRUB SPECIES *******																
201 ARCUVA	1(T)	-( )	-( )	1(T)	-( )	-( )	2(3)	1(T)	2(T)	-( )	5(T)	-( )	-( )	-( )	-( )	-( )
206 LINBOR	4(14)	3(1)	6(9)	1(T)	5(3)	-( )	2(T)	5(17)	7(21)	2(13)	-( )	2(T)	10(3)	-( )	4(10)	2(3)
FERNS AND ALLIES *******																
271 POLAND	1(T)	1(3)	1(2)	-( )	-( )	-( )	-( )	1(3)	-( )	2(2)	5(3)	-( )	-( )	-( )	-( )	-( )
GRAMINOIDS	************															
303 BROCAR	1(T)	-( )	1(T)	2(T)	5(T)	-( )	2(T)	1(T)	-( )	2(T)	-( )	-( )	-( )	-( )	-( )	-( )
304 BROVUL	1(T)	3(T)	1(T)	2(1)	-( )	-( )	2(T)	-( )	2(T)	2(3)	-( )	-( )	-( )	3(T)	3(T)	2(T)
307 CALRUB	7(12)	5(3)	8(11)	4(1)	5(38)	10(2)	10(T)	9(12)	2(T)	5(7)	-( )	5(9)	-( )	6(5)	1(T)	-( )
308 CARCON	4(4)	3(1)	4(1)	7(1)	5(T)	7(8)	4(T)	5(2)	7(1)	5(4)	10(8)	2(3)	10(T)	-( )	3(T)	2(T)
309 CARGEY	5(5)	5(4)	8(3)	4(1)	5(T)	7(8)	4(T)	7(8)	5(T)	5(T)	10(T)	2(15)	10(T)	4(2)	2(T)	2(T)
311 CARROS	7(1)	7(T)	7(T)	7(4)	-( )	7(T)	8(T)	7(T)	5(T)	8(2)	5(T)	5(2)	-( )	-( )	2(T)	2(T)

316 ELYGLA	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	2(3)	-( )	2(T)	-( )	-( )	-( )	-( )
318 FESOCC	1(T)	-( )	4(T)	3(T)	-( )	3(3)	6(1)	-( )	2(T)	3(T)	-( )	2(T)	-( )	1(T)	1(T)	2(T)
326 LUZPAR	2(T)	2(8)	2(T)	3(T)	-( )	7(2)	8(1)	-( )	-( )	-( )	-( )	2(T)	-( )	-( )	-( )	2(T)
PERENNIAL FORBS	*******															
401 ACHMIL	1(T)	3(1)	4(T)	4(T)	5(T)	10(T)	6(T)	1(T)	7(T)	3(T)	5(T)	5(T)	-( )	-( )	-( )	-( )
405 ANAMAR	1(T)	8(1)	8(2)	7(6)	10(3)	7(2)	6(1)	4(1)	7(5)	8(1)	10(9)	7(T)	-( )	1(15)	-( )	-( )
413 ANTRAC	2(2)	3(T)	4(T)	2(T)	5(T)	7(T)	2(T)	3(1)	-( )	2(T)	5(T)	5(T)	-( )	1(T)	1(T)	-( )
578 ARELAT	1(T)	1(15)	3(17)	1(15)	-( )	7(20)	4(20)	1(T)	-( )	-( )	-( )	-( )	-( )	1(15)	2(19)	-( )
422 ARNLAT	7(4)	9(10)	7(5)	9(12)	10(8)	7(9)	10(38)	8(13)	7(10)	9(8)	10(19)	10(23)	-( )	7(38)	5(22)	8(19)
426 ASTCON	2(T)	1(T)	1(T)	2(T)	5(T)	3(T)	2(T)	1(T)	-( )	2(T)	-( )	10(1)	-( )	1(T)	2(T)	-( )
442 CHIUMB	7(T)	4(T)	4(T)	2(T)	-( )	-( )	-( )	4(T)	7(T)	5(T)	5(T)	2(T)	10(T)	9(1)	9(1)	8(2)
447 CLIUNI	1(T)	3(T)	1(2)	-( )	-( )	-( )	-( )	3(T)	2(T)	2(2)	-( )	-( )	-( )	3(T)	1(15)	3(2)
449 COPOCC	1(T)	1(T)	1(T)	-( )	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	2(2)	-( )
608 EPIALP	-( )	3(T)	1(T)	3(T)	-( )	3(T)	4(T)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
459 EPIANG	9(1)	10(21)	9(12)	10(40)	10(15)	10(6)	8(6)	6(2)	10(15)	10(8)	10(39)	10(8)	10(T)	1(T)	2(T)	-( )
465 FRAVES	2(1)	1(T)	3(T)	1(T)	5(3)	7(9)	-( )	3(6)	-( )	4(1)	-( )	5(T)	-( )	-( )	2(T)	-( )
466 FRAVIR	1(T)	1(T)	3(T)	1(T)	-( )	3(3)	2(T)	2(T)	-( )	2(T)	-( )	5(T)	-( )	1(T)	-( )	-( )
471 GALTRI	1(T)	2(T)	1(T)	5(T)	-( )	3(T)	4(T)	-( )	-( )	2(T)	5(T)	5(T)	-( )	1(T)	2(T)	2(T)
476 GOOOBL	5(T)	2(T)	1(T)	1(T)	-( )	-( )	-( )	3(T)	-( )	1(T)	-( )	-( )	-( )	9(T)	10(T)	8(1)
480 HEDOCC	-( )	-( )	1(15)	-( )	-( )	-( )	-( )	1(3)	-( )	-( )	5(T)	-( )	-( )	-( )	-( )	-( )
483 HIEALB	2(T)	3(T)	3(T)	1(T)	-( )	-( )	-( )	1(T)	2(T)	6(T)	10(T)	5(T)	-( )	1(T)	-( )	-( )
484 HIEALF	3(T)	2(T)	4(T)	7(T)	-( )	7(T)	6(T)	-( )	2(T)	2(T)	-( )	2(T)	-( )	3(T)	2(T)	3(T)
499 LUPINU	1(T)	-( )	1(T)	-( )	-( )	3(T)	-( )	2(T)	-( )	2(T)	-( )	-( )	-( )	1(T)	-( )	-( )
502 MITSTA	2(6)	3(T)	3(T)	2(T)	-( )	-( )	2(T)	2(T)	2(T)	3(1)	10(T)	2(T)	-( )	1(3)	1(T)	-( )
505 OSMCHI	-( )	-( )	1(T)	2(T)	-( )	-( )	2(T)	-( )	2(T)	-( )	-( )	-( )	-( )	1(T)	2(T)	3(2)
507 PEDBRA	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	2(2)	-( )	2(T)	5(T)	-( )	-( )	-( )	1(T)	-( )
509 PEDRAC	1(T)	3(T)	2(T)	2(T)	-( )	-( )	-( )	3(T)	2(T)	2(T)	-( )	-( )	-( )	9(T)	3(T)	3(T)
510 PENALB	1(T)	1(T)	3(T)	1(T)	5(T)	3(T)	-( )	4(T)	2(T)	3(T)	10(T)	5(T)	-( )	-( )	-( )	-( )
519 POLPUL	-( )	-( )	-( )	1(3)	-( )	-( )	4(2)	-( )	-( )	2(T)	-( )	-( )	-( )	-( )	1(T)	-( )
526 PYRASA	3(T)	5(T)	3(T)	2(T)	-( )	-( )	-( )	5(T)	2(T)	2(T)	-( )	5(T)	-( )	3(T)	7(T)	8(1)
529 PYRSEC	5(T)	8(T)	3(T)	4(T)	-( )	-( )	4(T)	4(T)	10(T)	5(T)	5(T)	5(T)	10(T)	4(1)	10(T)	10(T)
531 PYRVIR	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	2(T)	1(T)	-( )	-( )	-( )	3(T)	2(T)	2(T)
870 SENFOE	1(T)	2(T)	1(T)	2(T)	-( )	-( )	2(T)	-( )	-( )	2(T)	-( )	-( )	-( )	-( )	-( )	-( )
539 SENTRI	-( )	1(T)	1(T)	3(T)	-( )	3(T)	6(T)	1(T)	2(T)	1(T)	-( )	-( )	-( )	3(T)	1(T)	2(T)
541 SILMEN	-( )	-( )	1(T)	-( )	-( )	3(T)	2(T)	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	2(T)	2(3)
542 SMIRAC	1(T)	-( )	1(T)	-( )	-( )	-( )	-( )	1(15)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	2(T)
543 SMISTE	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	1(T)	-( )	2(T)	-( )	-( )	-( )	1(T)	2(T)	-( )
544 SOLMIS	-( )	1(T)	-( )	-( )	5(T)	-( )	-( )	-( )	-( )	2(2)	-( )	-( )	-( )	-( )	-( )	-( )
547 THAOCC	5(T)	4(1)	4(T)	6(T)	-( )	10(T)	6(1)	5(T)	5(2)	5(1)	5(T)	10(T)	-( )	7(1)	8(2)	2(3)
560 TRIOVA	1(T)	1(T)	1(T)	-( )	-( )	-( )	2(T)	1(T)	-( )	-( )	-( )	-( )	-( )	1(T)	2(T)	2(T)
551 VALSIT	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	1(3)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
552 VERVIR	-( )	1(T)	-( )	2(T)	-( )	3(T)	2(T)	-( )	-( )	1(T)	-( )	-( )	-( )	1(T)	1(T)	-( )
557 VIOORB	2(T)	5(T)	3(2)	2(T)	5(T)	3(T)	4(T)	3(T)	7(T)	2(T)	5(T)	5(T)	-( )	10(T)	6(T)	7(1)
558 XERTEN	10(10)	9(3)	8(9)	9(5)	-( )	3(T)	8(2)	9(9)	7(5)	9(9)	10(2)	2(3)	10(3)	10(15)	9(15)	7(23)

****

* CODE TO CONSTANCY VALUES

+ = 0-5%	2 = 15-25%	4 = 35-45%	6 = 55-65%	8 = 75-85%	10 = 95-100%
1 = 5-15%	3 = 25-35%	5 = 45-55%	7 = 65-75%	9 = 85-95%	

(CANOPY COVERAGE EXPRESSED TO NEAREST %)

APPENDIX A-7.—CONSTANCY* AND AVERAGE CANOPY COVERAGE (PERCENT) OF IMPORTANT PLANTS IN EACH COMMUNITY TYPE OF THE ABLA/MEFE, COLD PHASE

(Abbreviated scientific names of plants are listed below; full names are listed in appendix B.)

STRUCTURAL STAGE	SHRUB-HERB					SAPLING				POLE	MATURE	OLD GROWTH
Community Type	MEFE VACC	EPAN MEFE	EPAN	WET MEADOW	MEFE WET MEADOW	ABLA-(PIEN)/ MEFE-VACC	PICO-(PIEN-ABLA)/ MEFE VACC	PICO-(PIEN-ABLA)/ MEFE-EPAN	PICO-(PIEN-ABLA)/ WET MEADOW	PICO-(PIEN-ABLA)/ MEFE-VACC	PICO-PIEN-ABLA/ MEFE-VACC	ABLA PIEN/ MEFE-VACC
Number of Plots	15	5	12	9	3	5	5	2	5	4	7	7
TREE SPECIES ********												
2 ABILAS	9(8)	10(4)	10(T)	10(1)	10(6)	10(20)	10(16)	10(15)	10(7)	10(8)	10(15)	10(23)
6 LAROCC	-( )	4(T)	1(T)	-( )	-( )	-( )	6(5)	-( )	2(T)	-( )	-( )	3(T)
7 PICENG	9(3)	8(2)	7(4)	9(1)	10(1)	10(12)	8(5)	10(9)	10(2)	7(2)	9(18)	10(28)
9 PINALB	3(2)	-( )	3(T)	8(T)	3(T)	4(T)	6(1)	5(T)	2(3)	7(1)	4(1)	9(T)
10 PINCON	8(6)	10(11)	10(3)	4(1)	3(T)	6(6)	10(20)	5(3)	10(7)	10(68)	10(10)	7(2)
12 PINMON	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	2(T)	1(3)	-( )
15 POPTRI	-( )	2(T)	3(1)	-( )	-( )	-( )	-( )	-( )	2(T)	-( )	-( )	-( )
16 PSEMEN	3(T)	4(2)	2(T)	-( )	-( )	4(2)	4(T)	5(T)	2(T)	5(T)	1(3)	3(2)
19 TSUMER	1(T)	-( )	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	3(T)
SHRUB SPECIES ********												
104 ALNSIN	5(5)	6(5)	4(3)	2(2)	-( )	2(T)	2(T)	10(2)	4(T)	5(T)	-( )	-( )
115 LONUTA	3(1)	-( )	-( )	4(1)	7(2)	6(6)	2(T)	-( )	8(1)	2(T)	3(T)	1(T)
116 MENFER	10(37)	10(20)	10(2)	10(5)	10(70)	10(58)	10(25)	10(26)	10(10)	10(26)	10(48)	10(67)
118 PACMYR	-( )	2(15)	-( )	1(3)	-( )	-( )	2(T)	5(3)	-( )	2(T)	-( )	-( )
130 RIBLAC	3(1)	8(1)	6(T)	8(3)	7(9)	6(2)	-( )	10(T)	6(1)	-( )	-( )	-( )
131 RIBVIS	2(2)	4(T)	-( )	1(T)	3(T)	-( )	-( )	5(T)	2(T)	2(T)	-( )	-( )
136 RUBPAR	3(3)	4(T)	2(T)	2(8)	7(2)	2(T)	-( )	5(T)	-( )	2(T)	-( )	-( )
137 SALSCO	4(8)	6(1)	7(T)	4(T)	-( )	4(T)	8(5)	5(T)	10(T)	5(2)	-( )	-( )
138 SAMRAC	4(T)	4(T)	4(1)	9(4)	7(T)	2(T)	2(T)	5(3)	8(T)	-( )	1(T)	-( )
140 SORSCO	1(2)	2(T)	-( )	1(T)	-( )	-( )	-( )	-( )	2(T)	2(T)	-( )	-( )
142 SPIBET	3(4)	8(1)	1(T)	-( )	3(T)	-( )	2(T)	-( )	-( )	-( )	1(T)	-( )
146 VACGLO	10(18)	10(20)	10(5)	9(2)	10(7)	8(8)	8(10)	10(9)	10(10)	10(23)	10(20)	9(20)
147 VACMYR	-( )	-( )	-( )	-( )	-( )	-( )	2(15)	-( )	2(38)	-( )	-( )	1(38)
148 VACSCO	9(27)	10(7)	8(6)	10(8)	10(5)	10(31)	8(38)	5(38)	6(2)	10(41)	10(31)	7(24)
SUBSHRUB SPECIES *******												
206 LINBOR	-( )	-( )	-( )	-( )	-( )	2(T)	2(T)	-( )	-( )	2(15)	-( )	-( )
FERNS AND ALLIES *******												
271 POLAND	2(1)	2(3)	1(15)	2(2)	-( )	4(2)	-( )	5(T)	-( )	5(T)	-( )	-( )
GRAMINOIDS ************												
302 AGRSPP	-( )	-( )	-( )	1(T)	-( )	-( )	-( )	-( )	6(T)	-( )	-( )	-( )
303 BROCAR	1(T)	2(T)	1(T)	1(T)	7(T)	-( )	-( )	-( )	2(T)	-( )	-( )	-( )
305 CALCAN	1(T)	-( )	-( )	3(T)	-( )	-( )	2(T)	-( )	4(T)	-( )	-( )	-( )
306 CALPUR	-( )	-( )	1(3)	3(1)	3(3)	-( )	-( )	-( )	-( )	-( )	1(T)	-( )
307 CALRUB	3(7)	2(15)	2(1)	1(15)	3(T)	4(8)	2(T)	-( )	-( )	5(9)	-( )	-( )
308 CARCON	3(T)	6(1)	3(4)	6(4)	-( )	2(T)	6(T)	5(T)	2(T)	2(T)	-( )	-( )
309 CARGEY	5(1)	10(2)	7(5)	9(10)	-( )	4(9)	2(T)	5(T)	6(14)	2(T)	3(T)	-( )
275 CARILL	-( )	-( )	2(T)	6(10)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
311 CARROS	7(2)	10(5)	10(10)	10(6)	10(5)	8(5)	10(T)	5(15)	10(3)	-( )	-( )	-( )

313 CINLAT	-( )	-( )	-( )	-( )	3(T)	-( )	-( )	-( )	2(3)	-( )	-( )	-( )
314 DESATR	-( )	-( )	-( )	1(3)	3(T)	-( )	-( )	-( )	2(T)	-( )	1(T)	-( )
316 ELYGLA	-( )	-( )	2(T)	1(T)	-( )	-( )	-( )	-( )	4(8)	-( )	-( )	-( )
318 FESOCC	-( )	2(3)	2(3)	1(3)	-( )	-( )	-( )	-( )	2(T)	-( )	-( )	-( )
325 LUZHIT	2(1)	2(T)	2(T)	7(6)	3(T)	-( )	-( )	-( )	6(1)	-( )	3(T)	1(T)
326 LUZPAR	-( )	4(3)	2(1)	4(1)	3(3)	2(T)	-( )	10(T)	6(5)	-( )	-( )	-( )
279 POACAN	1(T)	-( )	-( )	1(T)	3(T)	-( )	-( )	-( )	6(T)	-( )	-( )	-( )
334 TRISPI	-( )	2(T)	2(2)	1(T)	-( )	-( )	-( )	-( )	4(T)	-( )	-( )	-( )
PERENNIAL FORBS	*******											
401 ACHMIL	-( )	-( )	2(T)	-( )	-( )	-( )	2(T)	-( )	4(T)	-( )	-( )	-( )
405 ANAMAR	3(1)	8(5)	10(7)	8(3)	3(T)	4(T)	8(T)	10(9)	8(2)	-( )	-( )	-( )
951 ANGDAW	-( )	-( )	-( )	4(5)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
414 ANTMIC	1(T)	-( )	2(T)	-( )	-( )	-( )	-( )	-( )	4(2)	-( )	-( )	-( )
420 AREMAC	-( )	-( )	1(3)	1(T)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
422 ARNLAT	5(3)	6(15)	7(5)	9(9)	10(6)	10(6)	8(1)	10(26)	10(14)	10(9)	4(10)	6(5)
442 CHIUMB	5(T)	4(T)	-( )	-( )	-( )	2(T)	2(3)	10(T)	-( )	10(2)	1(T)	4(T)
597 CIRUND	-( )	-( )	2(T)	2(2)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
447 CLIUNI	-( )	-( )	-( )	3(T)	7(T)	-( )	-( )	5(T)	-( )	-( )	1(T)	-( )
458 DODJEF	-( )	-( )	-( )	4(2)	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )
608 EPIALP	3(T)	8(T)	7(T)	4(2)	7(T)	-( )	-( )	5(T)	6(T)	-( )	-( )	-( )
459 EPIANG	7(T)	10(15)	10(32)	9(16)	10(1)	8(T)	10(1)	10(26)	10(4)	-( )	-( )	-( )
471 GALTRI	-( )	-( )	-( )	-( )	-( )	-( )	-( )	-( )	2(3)	-( )	-( )	-( )
476 GOOOBL	3(T)	-( )	-( )	-( )	-( )	2(T)	2(T)	5(T)	-( )	5(T)	9(T)	6(T)
483 HIEALB	3(1)	2(3)	2(2)	1(T)	-( )	4(T)	4(T)	5(T)	-( )	2(T)	-( )	-( )
484 HIEALF	1(T)	4(T)	3(T)	1(T)	-( )	-( )	4(T)	-( )	4(T)	-( )	1(T)	-( )
489 LIGCAN	-( )	-( )	-( )	4(1)	7(T)	-( )	-( )	-( )	2(T)	-( )	-( )	1(T)
499 LUPINU	1(T)	4(T)	1(T)	6(3)	-( )	4(2)	-( )	-( )	2(T)	-( )	1(T)	-( )
649 MITPEN	-( )	-( )	-( )	-( )	3(3)	-( )	-( )	-( )	-( )	-( )	-( )	-( )
502 MITSTA	-( )	2(3)	-( )	-( )	3(T)	-( )	-( )	5(T)	4(2)	-( )	1(T)	-( )
505 OSMCHI	-( )	-( )	-( )	-( )	3(T)	-( )	-( )	-( )	2(3)	-( )	-( )	-( )
509 PEDRAC	1(T)	2(T)	-( )	-( )	-( )	4(T)	4(T)	-( )	2(T)	2(T)	1(T)	1(T)
510 PENALB	-( )	4(T)	1(T)	1(3)	-( )	-( )	2(T)	-( )	-( )	-( )	-( )	-( )
519 POLPUL	1(T)	-( )	-( )	1(T)	7(8)	-( )	-( )	-( )	6(2)	-( )	-( )	-( )
526 PYRASA	4(T)	2(T)	-( )	-( )	-( )	6(T)	4(T)	5(T)	-( )	10(T)	4(T)	3(T)
529 PYRSEC	3(T)	2(T)	2(T)	-( )	3(T)	2(T)	2(T)	-( )	-( )	10(T)	6(1)	10(T)
539 SENTRI	1(T)	4(T)	2(T)	10(9)	10(3)	2(T)	-( )	5(T)	10(5)	-( )	3(T)	1(T)
544 SOLMIS	-( )	-( )	-( )	-( )	-( )	-( )	2(T)	-( )	6(T)	-( )	-( )	-( )
547 THAOCC	1(T)	-( )	1(T)	6(7)	3(T)	2(T)	-( )	-( )	4(2)	2(T)	1(T)	1(T)
548 TIATRI	-( )	4(T)	-( )	2(T)	7(T)	2(3)	-( )	5(T)	2(T)	-( )	1(T)	1(T)
560 TRIOVA	-( )	-( )	1(T)	2(T)	3(T)	-( )	-( )	-( )	-( )	2(T)	1(T)	-( )
690 TROLAX	-( )	-( )	-( )	8(T)	-( )	-( )	-( )	-( )	2(T)	-( )	-( )	-( )
551 VALSIT	-( )	2(T)	-( )	4(2)	3(T)	-( )	-( )	-( )	2(15)	-( )	-( )	-( )
552 VERVIR	-( )	2(3)	-( )	8(2)	7(T)	-( )	-( )	-( )	4(3)	-( )	1(T)	1(T)
557 VIOORB	1(T)	4(T)	2(T)	3(T)	7(T)	2(T)	4(T)	5(T)	6(T)	7(T)	4(T)	4(T)
558 XERTEN	10(21)	8(18)	9(5)	9(10)	10(6)	10(10)	10(12)	10(3)	10(4)	7(31)	10(21)	10(26)

****
****

* CODE TO CONSTANCY VALUES

+ = 0-5%	2 = 15-25%	4 = 35-45%	6 = 55-65%	8 = 75-85%	10 = 95-100%
1 = 5-15%	3 = 25-35%	5 = 45-55%	7 = 65-75%	9 = 85-95%	

(CANOPY COVERAGE EXPRESSED TO NEAREST %)

APPENDIX B.—SCIENTIFIC NAMES OF SPECIES CODED IN APPENDIX A

TREE SPECIES	GENUS	SPECIES
ABIGRA	ABIES	GRANDIS
ABILAS	ABIES	LASIOCARPA
LAROCC	LARIX	OCCIDENTALIS
PICENG	PICEA	ENGELMANNII
PINALB	PINUS	ALBICAULIS
PINCON	PINUS	CONTORTA
PINMON	PINUS	MONTICOLA
PINPON	PINUS	PONDEROSA
POPTRE	POPULUS	TREMULOIDES
POPTRI	POPULUS	TRICHOCARPA
PSEMEN	PSEUDOTSUGA	MENZIESII
TSUMER	TSUGA	MERTENSIANA

SHRUB SPECIES		
ACEGLA	ACER	GLABRUM
ALNSIN	ALNUS	SINUATA
AMEALN	AMELANCHIER	ALNIFOLIA
CEASAN	CEANOTHUS	SANGUINEUS
CEAVEL	CEANOTHUS	VELUTINUS
HOLDIS	HOLODISCUS	DISCOLOR
LONUTA	LONICERA	UTAHENSIS
MENFER	MENZIESIA	FERRUGINEA
PACMYR	PACHISTIMA	MYRSINITES
PHILEW	PHILADELPHUS	LEWISII
PHYMAL	PHYSOCARPUS	MALVACEUS
PRUEMA	PRUNUS	EMARGINATA
PRUVIR	PRUNUS	VIRGINIANA
PURTRI	PURSHIA	TRIDENTATA
RIBCER	RIBES	CEREUM
RIBLAC	RIBES	LACUSTRE
RIBVIS	RIBES	VISCOSISSIMUM
ROSACI	ROSA	ACICULARIS
ROSGYM	ROSA	GYMNOCARPA
ROSWOO	ROSA	WOODSII
RUBIDA	RUBUS	IDAEUS
RUBPAR	RUBUS	PARVIFLORUS
SALSCO	SALIX	SCOULERIANA
SAMCER	SAMBUCUS	CERULEA
SAMRAC	SAMBUCUS	RACEMOSA
SHECAN	SHEPHERDIA	CANADENSIS
SORSCO	SORBUS	SCOPULINA
SPIBET	SPIRAEA	BETULIFOLIA
SYMALB	SYMPHORICARPOS	ALBUS
SYMORE	SYMPHORICARPOS	OREOPHILUS
TAXBRE	TAXUS	BREVIFOLIA

PERENNIAL FORBS		
ACHMIL	ACHILLEA	MILLEFOLIUM
ALLCER	ALLIUM	CERNUUM
ANAMAR	ANAPHALIS	MARGARITACEAE
ANGDAW	ANGELICA	DAWSONII
ANTANA	ANTENNARIA	ANAPHALOIDES
ANTMIC	ANTENNARIA	MICROPHYLLA
ANTRAC	ANTENNARIA	RACEMOSA
APOAND	APOCYNUM	ANDROSAEMIFOLIUM
ARECON	ARENARIA	CONGESTA
ARELAT	ARENARIA	LATERIFLORA
AREMAC	ARENARIA	MACROPHYLLA
ARNCOR	ARNICA	CORDIFOLIA
ARNLAT	ARNICA	LATIFOLIA
ASTCON	ASTER	CONSPICUUS
ASTFOL	ASTER	FOLIACEUS
ASTLAE	ASTER	LAEVIS
ASTCAN	ASTRAGALUS	CANADENSIS
ASTMIS	ASTRAGALUS	MISER
BALSAG	BALSAMORHIZA	SAGITTATA
CAMROT	CAMPANULA	ROTUNDIFOLIA
CASMIN	CASTILLEJA	MINIATA
CHIMEN	CHIMAPHILA	MENZIESII
CHIUMB	CHIMAPHILA	UMBELLATA
CIRUND	CIRSIUM	UNDULATUM
CLIUNI	CLINTONIA	UNIFLORA
COPOCC	COPTIS	OCCIDENTALIS
DISTRA	DISPORUM	TRACHYCARPUM
DODJEF	DODECATHEON	JEFFREYI
EPIALP	EPILOBIUM	ALPINUM
EPIANG	EPILOBIUM	ANGUSTIFOLIUM
ERYGRA	ERYTHRONIUM	GRANDIFLORUM
FRAVES	FRAGARIA	VESCA
FRAVIR	FRAGARIA	VIRGINIANA
GALTRI	GALIUM	TRIFLORUM
GEUTRI	GEUM	TRIFLORUM
GOOOBL	GOODYERA	OBLONGIFOLIA
HABELE	HABENARIA	ELEGANS
HEDBOR	HEDYSARUM	BOREALIS
HEDOCC	HEDYSARUM	OCCIDENTALIS
HEDSUL	HEDYSARUM	SULPHURESCENS
HEUCYL	HEUCHERA	CYLINDRICA
HIEALB	HIERACIUM	ALBERTINUM & CYNOGLO
HIEALF	HIERACIUM	ALBIFLORUM
ILLRIV	ILLIAMNA	RIVULARIS
LIGCAN	LIGUSTICUM	CANBYI
LITRUD	LITHOSPERMUM	RUDERALE

APPENDIX B (con.)

VACGLO	VACCINIUM	GLOBULARE
VACMYR	VACCINIUM	MYRTILLUS
VACSCO	VACCINIUM	SCOPARIUM

SUBSHRUB SPECIES

ARCUVA	ARTOSTAPHYLOS	UVA-URSI
BERREP	BERBERIS	REPENS
CLECOL	CLEMATIS	COLUMBIANA
LINBOR	LINNAEA	BOREALIS
LONCIL	LONICERA	CILIOSA

FERNS AND ALLIES

POLAND	POLYSTICUM	ANDERSONII
PTEAQU	PTERIDIUM	AQUILINUM

GRAMINOIDS

AGRSPI	AGROPYRON	SPICATUM
AGRSPP	AGROSTIS	SPP.
BROCAR	BROMUS	CARINATUS
BROVUL	BROMUS	VULGARIS
CALCAN	CALAMAGROSTIS	CANADENSIS
CALPUR	CALAMAGROSTIS	PURPURASCENS
CALRUB	CALAMAGROSTIS	RUBESCENS
CARCON	CAREX	CONCINNOIDES
CARGEY	CAREX	GEYERI
CARILL	CAREX	ILLOTA
CARROS	CAREX	ROSSII
CINLAT	CINNA	LATIFOLIA
DACGLO	DACTYLIS	GLOMERATA
DESATR	DESCHAMPSIA	ATROPURPUREA
ELYGLA	ELYMUS	GLAUCUS
FESIDA	FESTUCA	IDAHOENSIS
FESOCC	FESTUCA	OCCIDENTALIS
FESSCA	FESTUCA	SCABRELLA
LUZHIT	LUZULA	HITCHCOCKII
LUZPAR	LUZULA	PARVIFLORA
POACAN	POA	CANBYI
POACOM	POA	COMPRESSA
POANER	POA	NERVOSA
TRISPI	TRISETUM	SPICATUM

LUPINU	LUPINUS	SPP
MITPEN	MITELLA	PENTANDRA
MITSTA	MITELLA	STAUROPETALA
OSMCHI	OSMORHIZA	CHILENSIS
OSMOCC	OSMORHIZA	OCCIDENTALIS
PEDBRA	PEDICULARIS	BRACTEOSA
PEDCON	PEDICULARIS	CONTORTA
PEDRAC	PEDICULARIS	RACEMOSA
PENALB	PENSTEMON	ALBERTINUS
PENCAE	PENSTEMON	CAELESTINUS
PENPRO	PENSTEMON	PROCERUS
PENWIL	PENSTEMON	WILCOXII
POLPUL	POLEMONIUM	PULCHERRIMUM
POTGLA	POTENTILLA	GLANDULOSA
PYRASA	PYROLA	ASARIFOLIA
PYRPIC	PYROLA	PICTA
PYRSEC	PYROLA	SECUNDA
PYRVIR	PYROLA	VIRENS
SEDSTE	SEDUM	STENOPETALUM
SENFOE	SENECIO	FOETIDUS
SENTRI	SENECIO	TRIANGULARIS
SILMEN	SILENE	MENZIESII
SMIRAC	SMILACINA	RACEMOSA
SMISTE	SMILACINA	STELLATA
SOLMIS	SOLIDAGO	MISSOURIENSIS
THAOCC	THALICTRUM	OCCIDENTALE
TIATRI	TIARELLA	TRIFOLIATA
TRIOVA	TRILLIUM	OVATUM
TROLAX	TROLLIUS	LAXUS
VALDIO	VALERIANA	DIOICA & OCCIDENTALI
VALSIT	VALERIANA	SITCHENSIS
VERVIR	VERATRUM	VIRIDE
VIOORB	VIOLA	ORBICULATA
XERTEN	XEROPHYLLUM	TENAX

ANNUALS

COLPAR	COLLINSIA	PARVIFLORA
EPIPAN	EPILOBIUM	PANICULATUM
MELLIN	MELAMPYRUM	LINEARE

APPENDIX C.—FIFTY-YEAR SITE INDEXES BY SPECIES FOR EACH HABITAT TYPE PHASE, COMPARED WITH SIMILARLY DERIVED VALUES FROM PFISTER AND OTHERS (1977) FOR WESTERN MONTANA[1]

Data from the current study							Data from Pfister and others 1977, for western Montana					
Habitat type and phase		Site indexes and maximum heights (in feet)					Habitat type	Site indexes and maximum heights (in feet)				
		Pinus ponderosa	Pseudotsuga menziesii	Larix occidentalis	Pinus contorta	Picea[2] engelmannii		Pinus ponderosa	Pseudotsuga menziesii	Larix occidentalis	Pinus contorta	Picea[2] englemannii
PSME/PHMA	Dry Phase	52 ± 9 93 ± 5	46 ± 3 84 ± 6				entire PSME/PHMA h.t.	59 ± 14 118 ± 20	58 ± 6 101 ± ?	57 ± ?	48 ± ?	
	Moist Phase		52 ± ?	60 ± 6 104 ± 17								
PSME/VAGL h.t. (includes some ABLA/XETE sites having poorly represented *Abies lasiocarpa*)		55 ± ? 100 ± ?	56 ± 11 88 ± 8	100 ± 17	51 ± 6		PSME/VAGL h.t.	115 ± 15	44 ± 4 85 ± 11			
ABLA/XETE	VAGL Phase		81 ± 12	100 ± ?	48 ± 4 81 ± 17		entire ABLA/XETE h.t.		40 ± 6 86 ± 8	51 ± ? 96 ± 10	46 ± 6 82 ± ?	56 ± ?
	VASC Phase				35 ± ? 69 ± 8							
ABLA/MEFE	Warm Phase		105 ± ?	109 ± 15	53 ± 4 95 ± ?	75 ± ? 124 ± 15	entire ABLA/MEFE h.t.		50 ± 8 95 ± ?	67 ± ? 106 ± 17	56 ± 6 88 ± 8	60 ± 10 109 ± 7
	Cold Phase				45 ± 5 85 ± ?	105 ± 10						

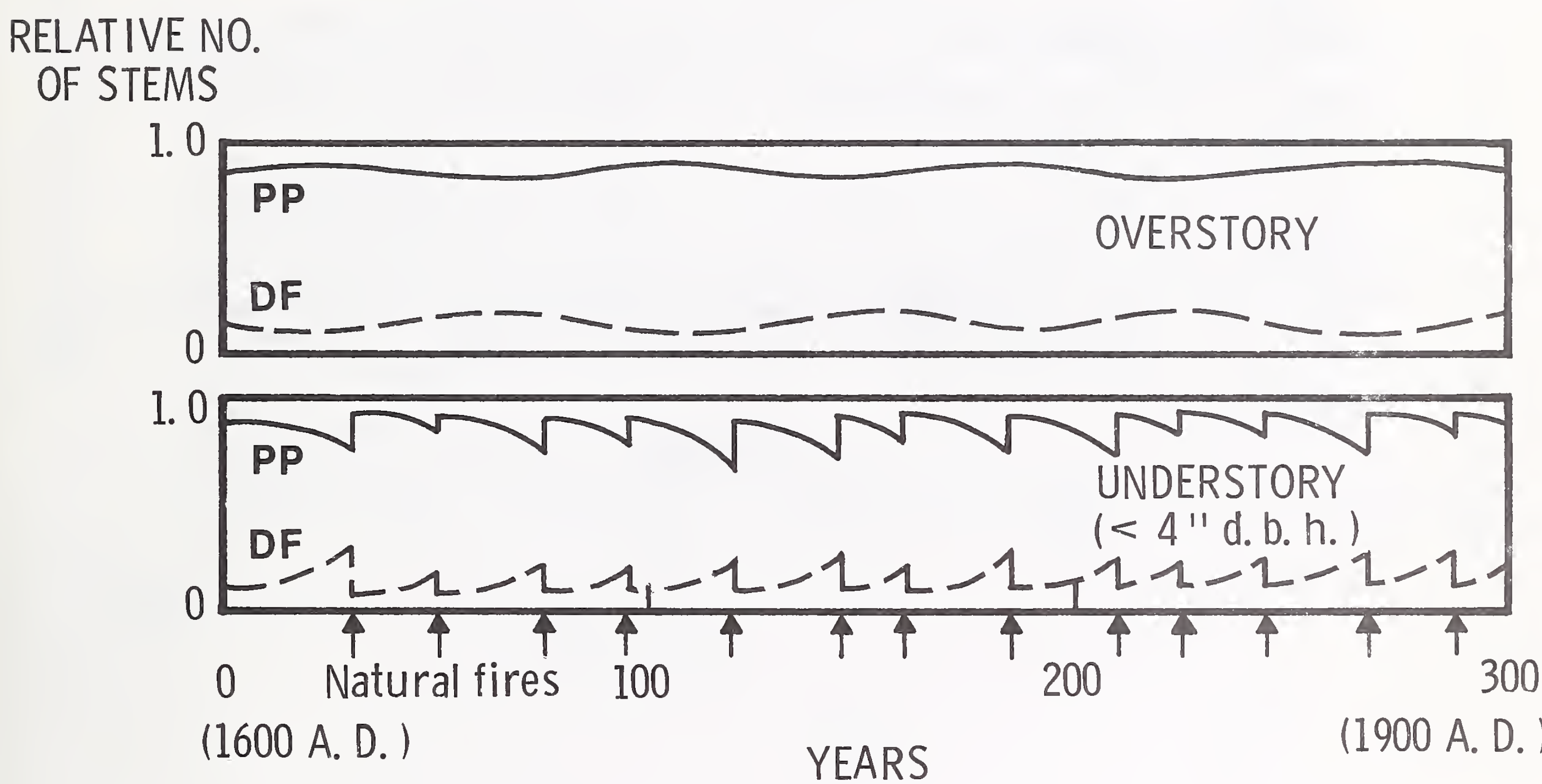
[1]Maximum heights of dominant old-growth trees are underlined. Means are shown where n = 3 or more; confidence limits for estimating the mean are given where n = 5 or more.

[2]Picea site indexes are based on breast-high age while other species have indexes based on total age.

APPENDIX D-1.—HYPOTHESIZED TREE SUCCESSION ON THE PSME/PHMA, DRY PHASE

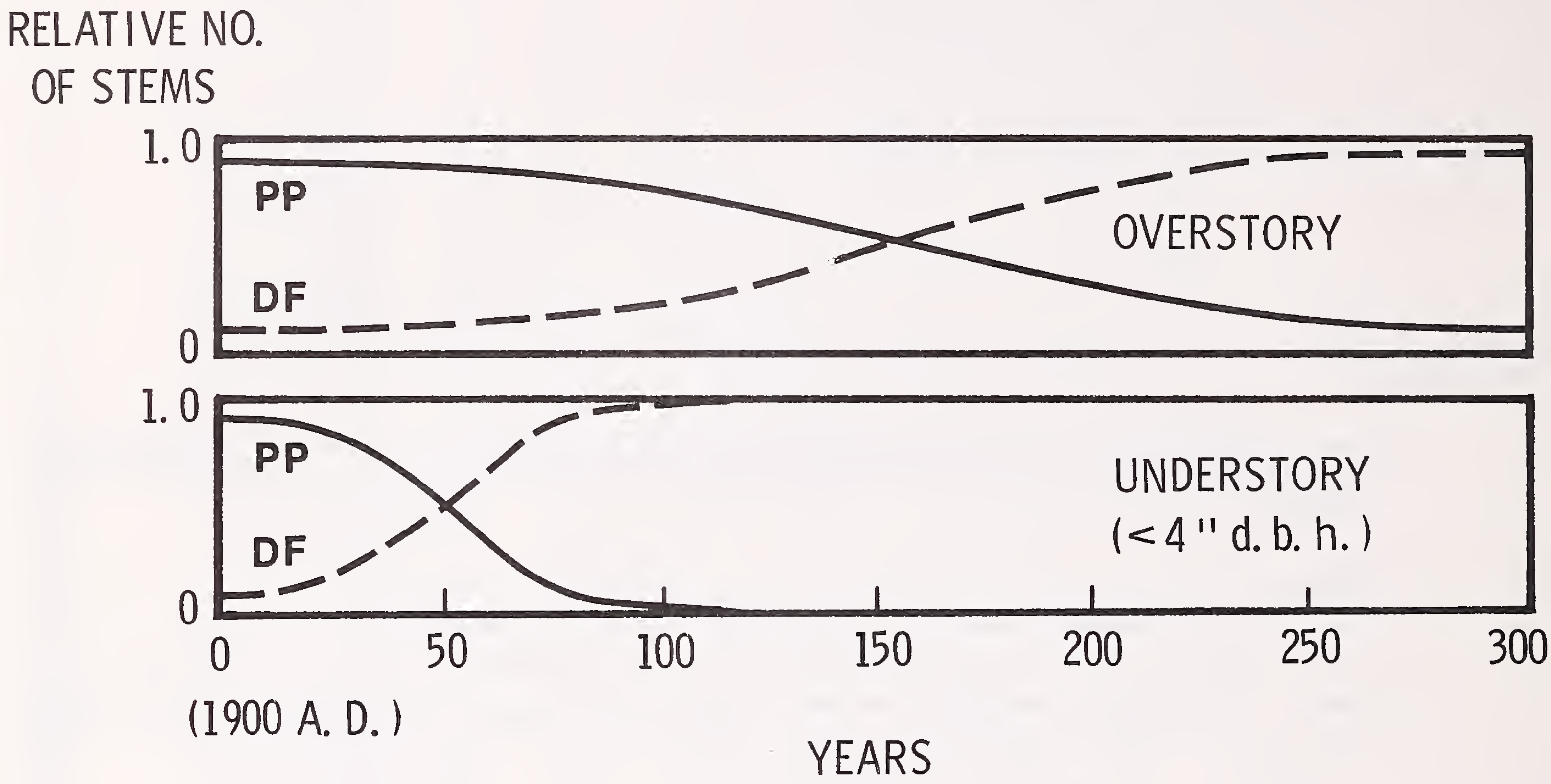
Case 1.—Natural Succession With Understory Fires

This figure shows a common pattern of tree succession in a pre-1900 stand in the dry phase. Low- to medium-intensity surface fires generally at 5- to 30-year intervals continually favored ponderosa pine (PP) by killing a higher proportion of the Douglas-fir (DF) regeneration (Arno 1976; Gruell and others 1982). Ponderosa pine saplings have thicker bark, thicker twigs and buds, and less foliage near the ground; thus, they are less vulnerable to light fires than Douglas-firs of comparable age. This fire regime maintained ponderosa pine as the major overstory component, resulting in parklike stands of large ponderosa pine (many age classes) with a relatively open understory.



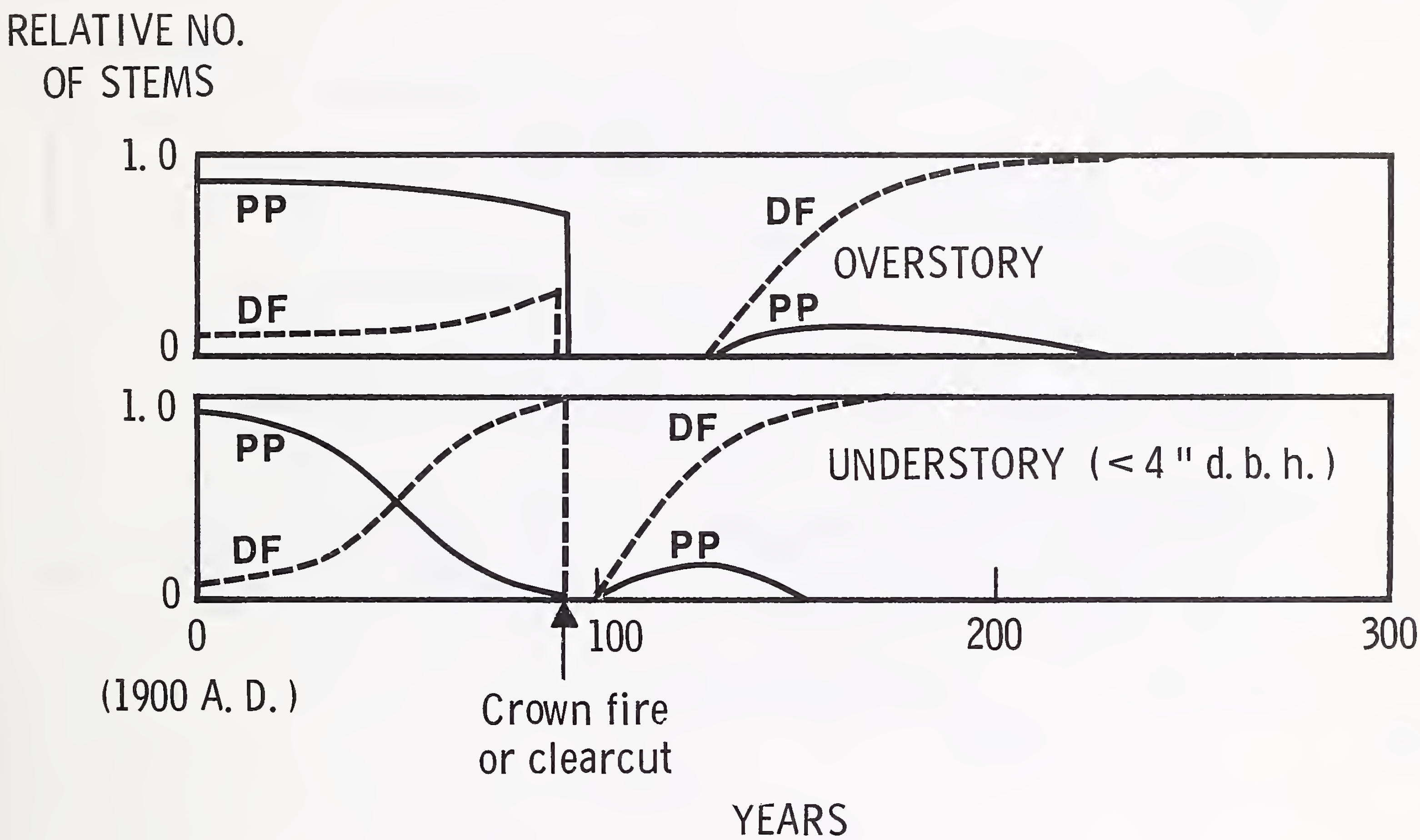
Case 2.—Natural Succession With Fire Suppression and No Cutting

This diagram represents the succession that typically occurs with fire suppression in the same type of primeval stand. After about 50 years without fire, Douglas-fir has become the understory dominant because of its greater shade tolerance. Ponderosa pine fails to regenerate and replace itself; thus the stand is converted to nearly pure Douglas-fir in 300 years.



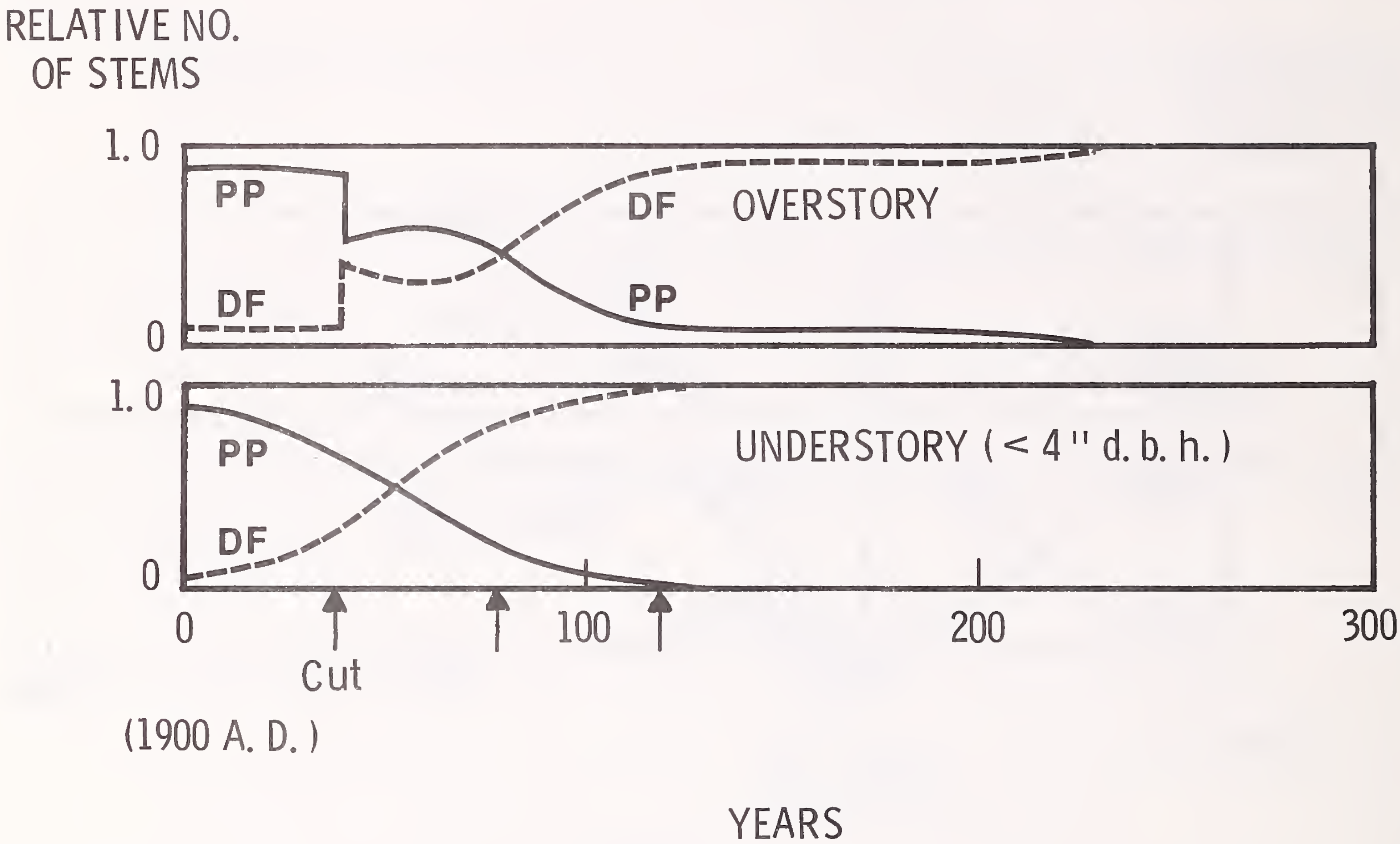
Case 3.—Stand-Replacing Fire or Clearcut Imposed on Case 2

The dense growth of understory Douglas-fir, resulting from fire suppression, forms a fuel ladder that allows a wildfire to crown and destroy the stand in year 90. Or, a clearcutting treatment is applied, followed by natural regeneration. After either of these stand-replacing treatments, Douglas-fir regenerates more abundantly than ponderosa pine. This results because Douglas-fir has lighter seeds that disperse readily from adjacent stands and the species is more shade tolerant than pine, allowing it to eventually regenerate even in shrub thickets. (The treatment reduces the total number of stems to zero, which is depicted in the relative number of stems.)



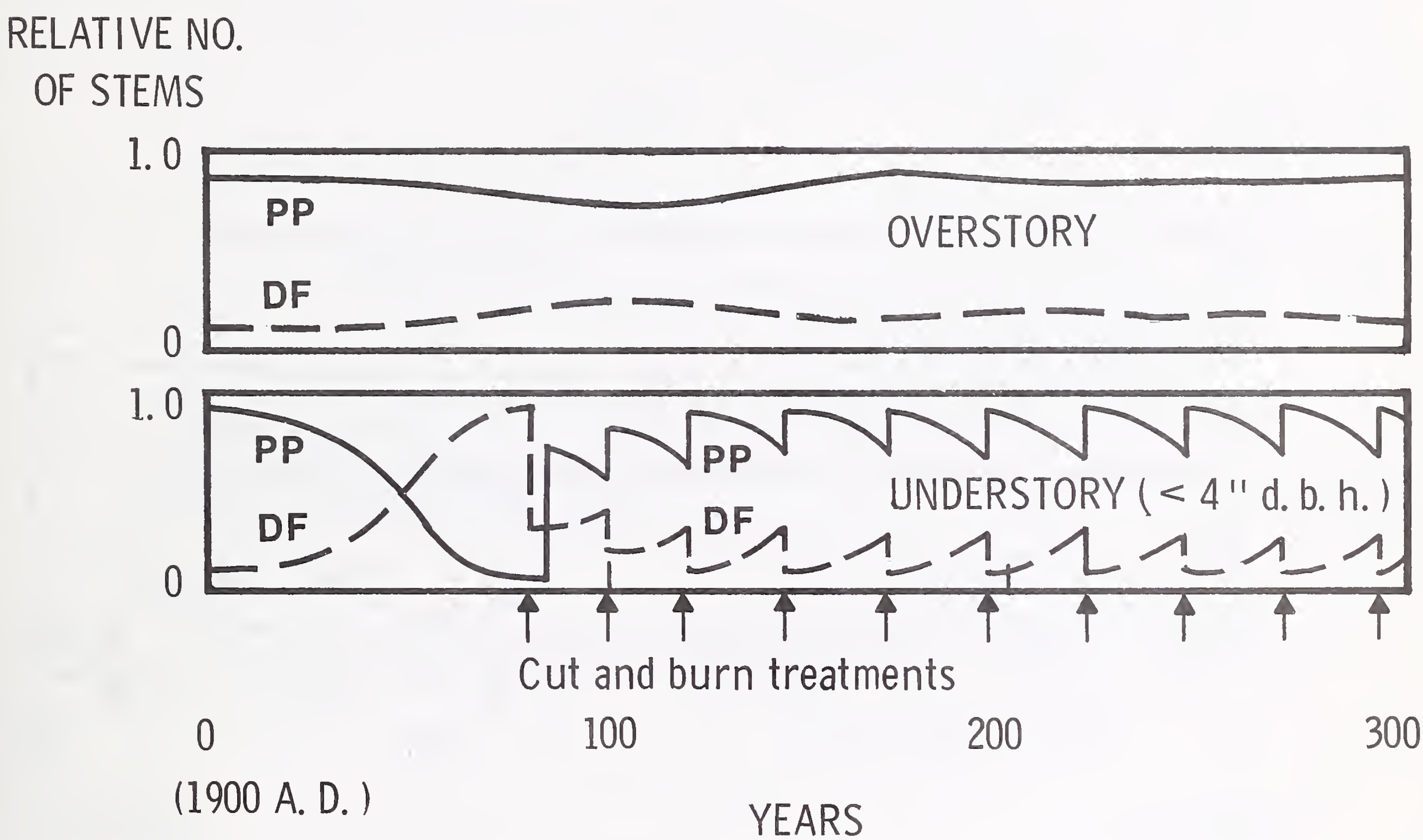
Case 4.—Selection Cutting Without Burning (Speed-up of Natural Succession)

The figure depicts a series of selective cuttings in which the large ponderosa pine are favored for harvest because of their high value. The first cutting is made 40 years after the last understory fire. Because no appreciable site preparation or burning accompanies the cutting, Douglas-fir regeneration is favored. Succession to Douglas-fir forest is accelerated by this type of cutting in the absence of understory fire. A dramatic example of this case is shown in photographs taken over a 39-year period in Gruell and others (1982, page 32).



Case 5.—Selection Cutting With Underburning to Favor Ponderosa Pine

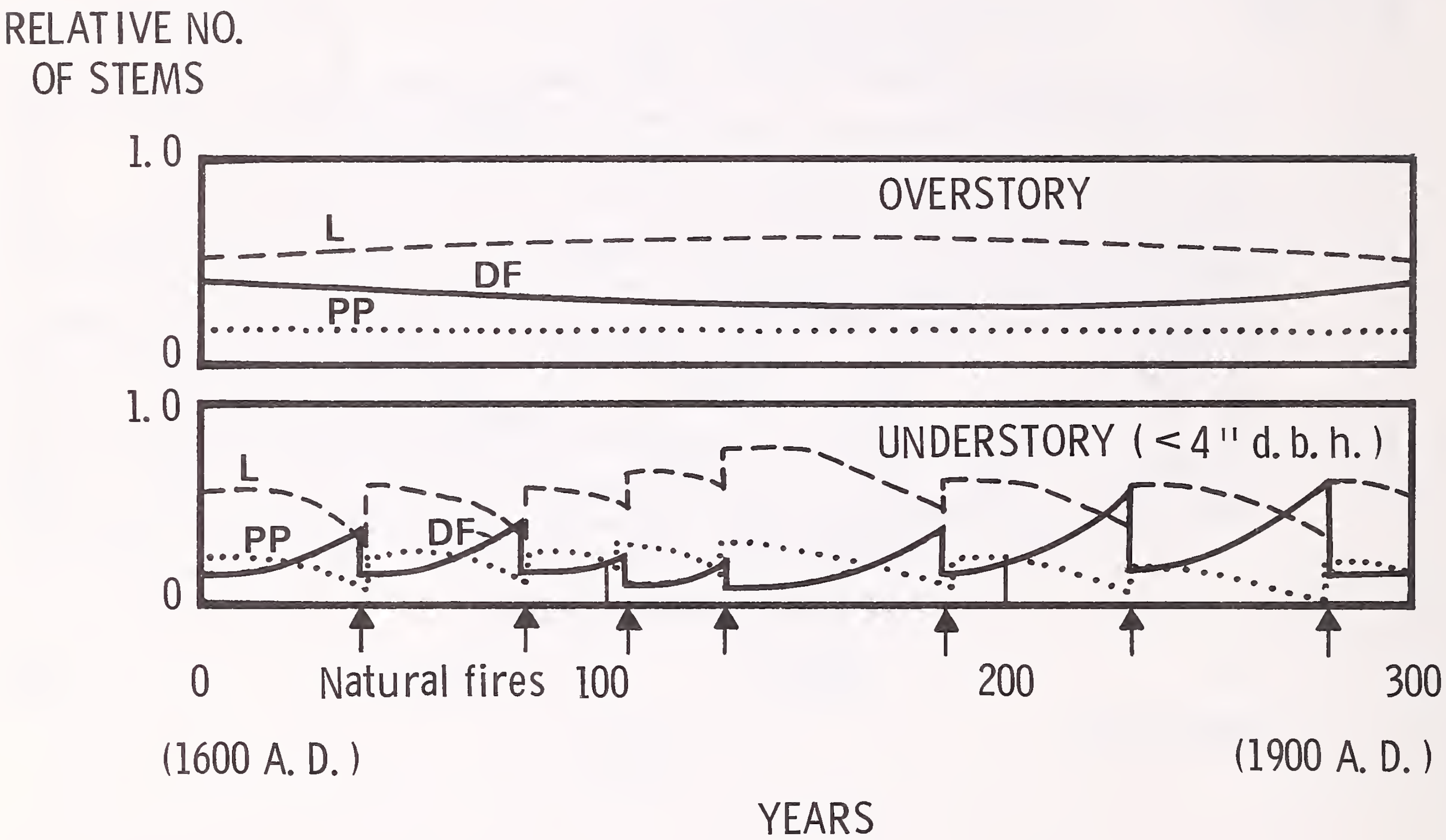
The hypothesized effects of selection cutting and prescribed underburns intended to favor regeneration of ponderosa pine are shown. The stand-opening cuttings and site-preparing burns were begun 80 years after the last understory wildfire. Most of the overstory Douglas-fir is removed in each cutting, while pines are left as a seed source. Larger proportions of understory Douglas-fir are killed with each treatment than ponderosa pine; thus, the result is a silviculturally perpetuated PP-DF forest that closely resembles the presettlement situation (case 1). A shelterwood cutting-underburn treatment could also be applied to perpetuate ponderosa pine through natural regeneration.



APPENDIX D-2.—HYPOTHESIZED TREE SUCCESSION ON THE PSME/PHMA, MOIST PHASE

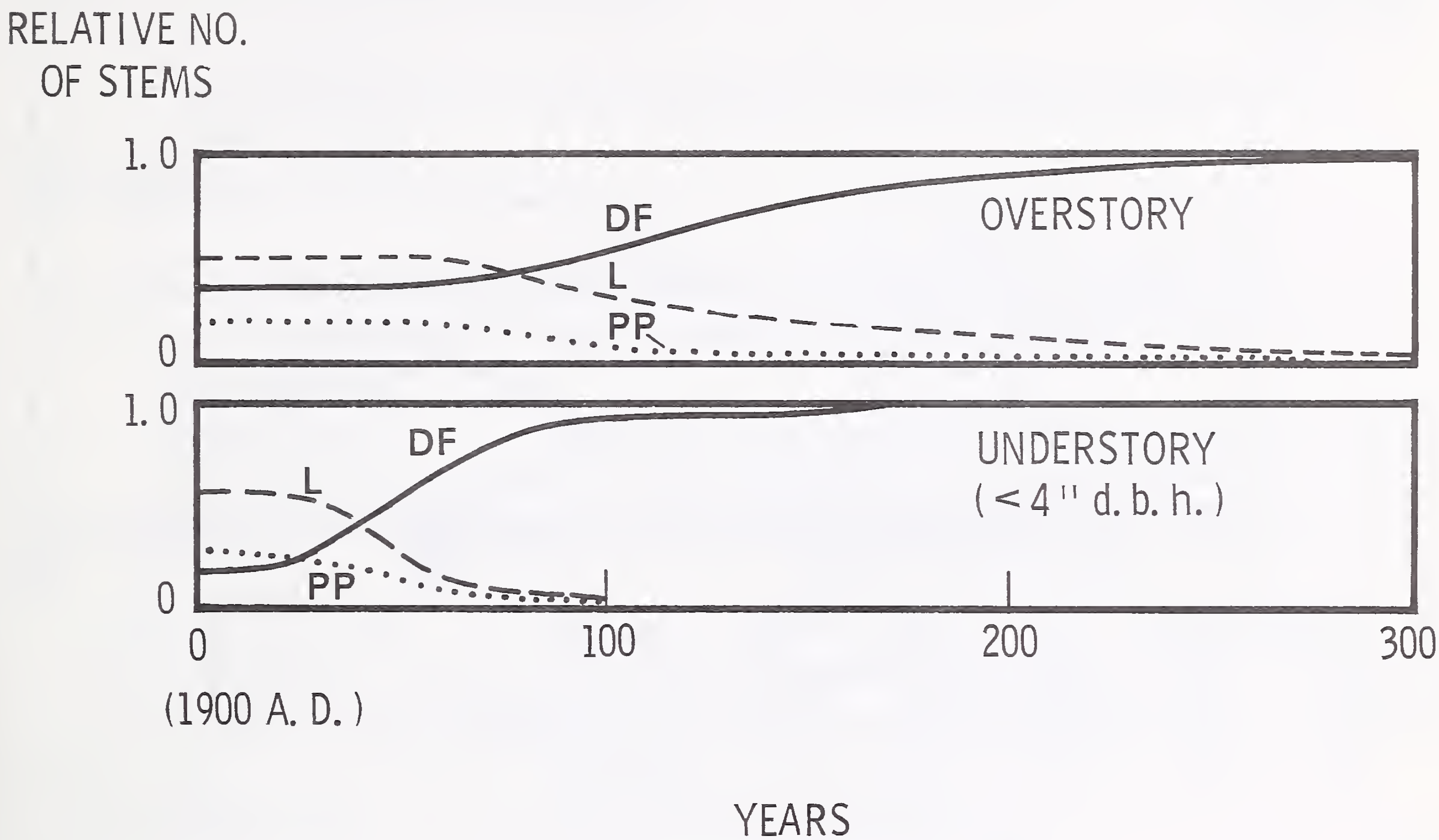
Case 1.—Natural Succession With Understory Fires

This figure shows a common pattern of tree succession in a pre-1900 stand in the moist phase. Low- to medium-intensity surface fires occurred at 10- to 50-year intervals, continually favoring western larch (L) and ponderosa pine (PP) by killing a high proportion of the Douglas-fir (DF) regeneration. Larch and ponderosa pine saplings are less vulnerable to light fires than Douglas-firs of comparable age. This fire regime maintained mixed, open stands of large larch, Douglas-fir, and ponderosa pine, with a patchy regeneration layer. Lodgepole pine is sometimes a minor component of this phase, but is not shown in this illustration.



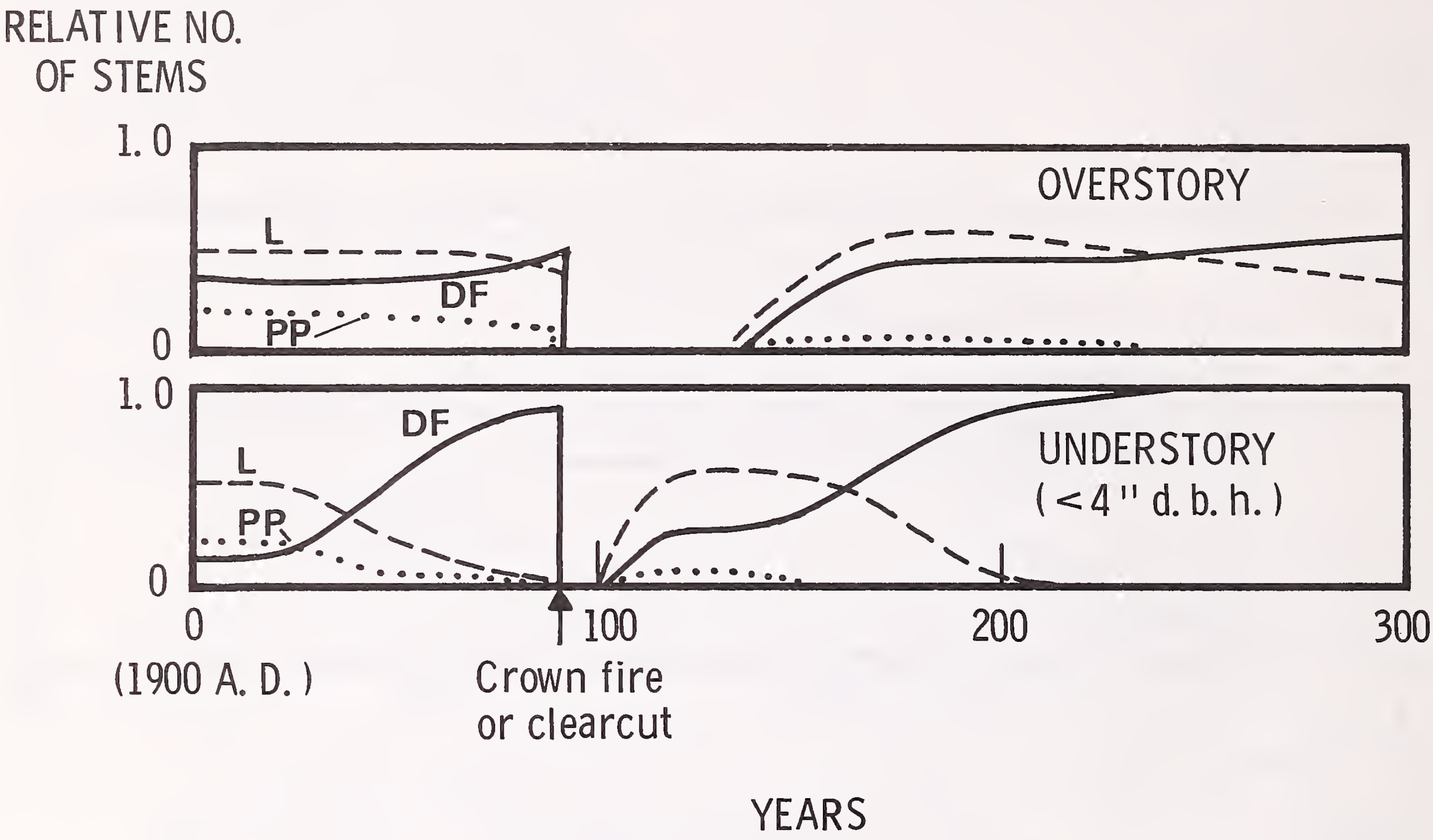
Case 2.—Natural Succession With Fire Suppression and No Cutting

This represents succession that occurs with fire suppression in the same type of primeval stand as in case 1. After about 50 years without fire, Douglas-fir has become the understory dominant because of its greater shade tolerance. Larch and ponderosa pine fail to regenerate and replace themselves; thus the stand is converted to nearly pure Douglas-fir by year 300. Partial cutting without scarification or underburning will tend to accelerate this succession to Douglas-fir.



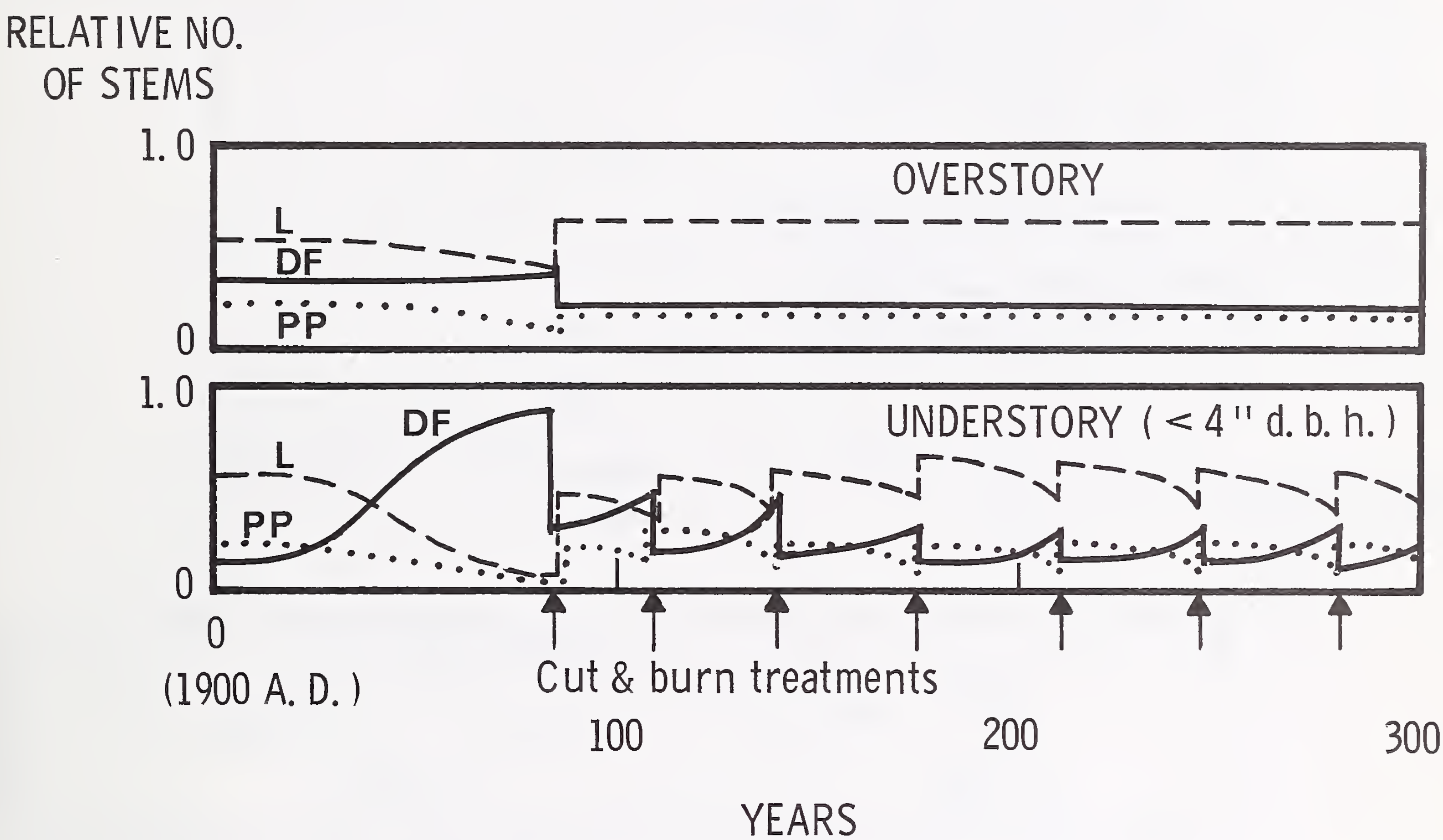
Case 3.—Stand Replacing Fire or Clearcut Imposed on Case 2

A severe wildfire or a clearcutting treatment occurs. Afterwards, larch and Douglas-fir, having lighter seeds that disperse readily from adjacent stands, regenerated much more abundantly than the heavy seeded ponderosa pine. (The treatment reduces the total number of stems nearly to zero, which is depicted in the relative number of stems.)



Case 4.—Selection Cutting With Underburning to Favor Larch and Ponderosa Pine

Hypothesized effects are shown for a silvicultural system of selection cutting and prescribed underburns intended to favor regeneration of larch and ponderosa pine. The stand-opening cuts and site-preparing burns were begun 80 years after the last understory wildfire. Larger proportions of understory Douglas-fir are killed with each treatment and, unlike clearcuts or stand-destroying fires, this treatment retains a ponderosa pine seed source. The result is a silviculturally perpetuated L-DF-PP forest that resembles the presettlement situation (case 1). A shelterwood cutting-underburn treatment could also be applied to perpetuate larch and ponderosa pine through natural regeneration.



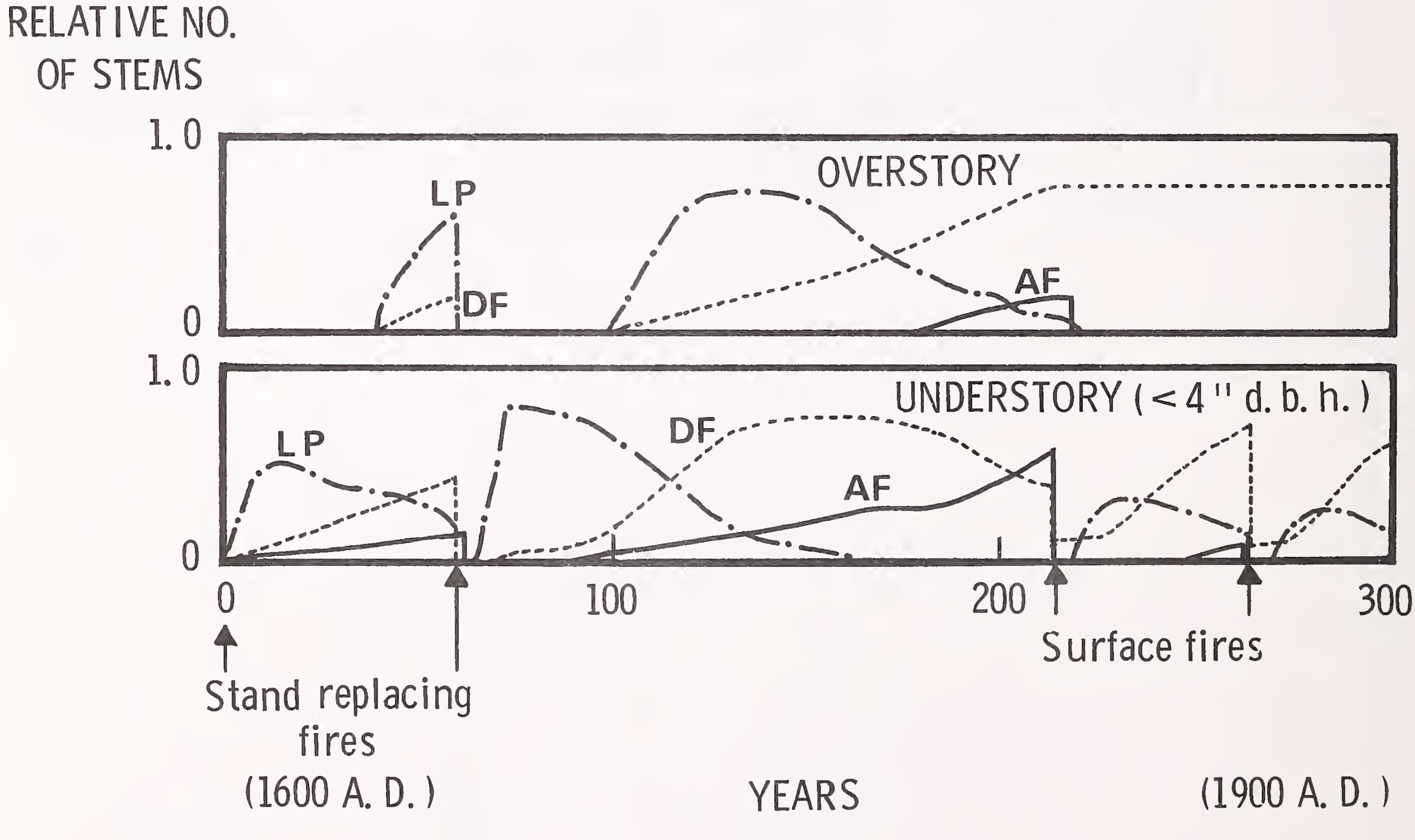
APPENDIX D-3.—THE PSME/VAGL, XETE PHASE

Hypothesized successional patterns of tree species are not presented for the PSME/VAGL, XETE phase; however, such patterns would parallel those shown for ABLA/XETE, VAGL phase if subalpine fir were deleted.

APPENDIX D-4.—HYPOTHESIZED TREE SUCCESSION ON THE ABLA/XETE, VAGL PHASE

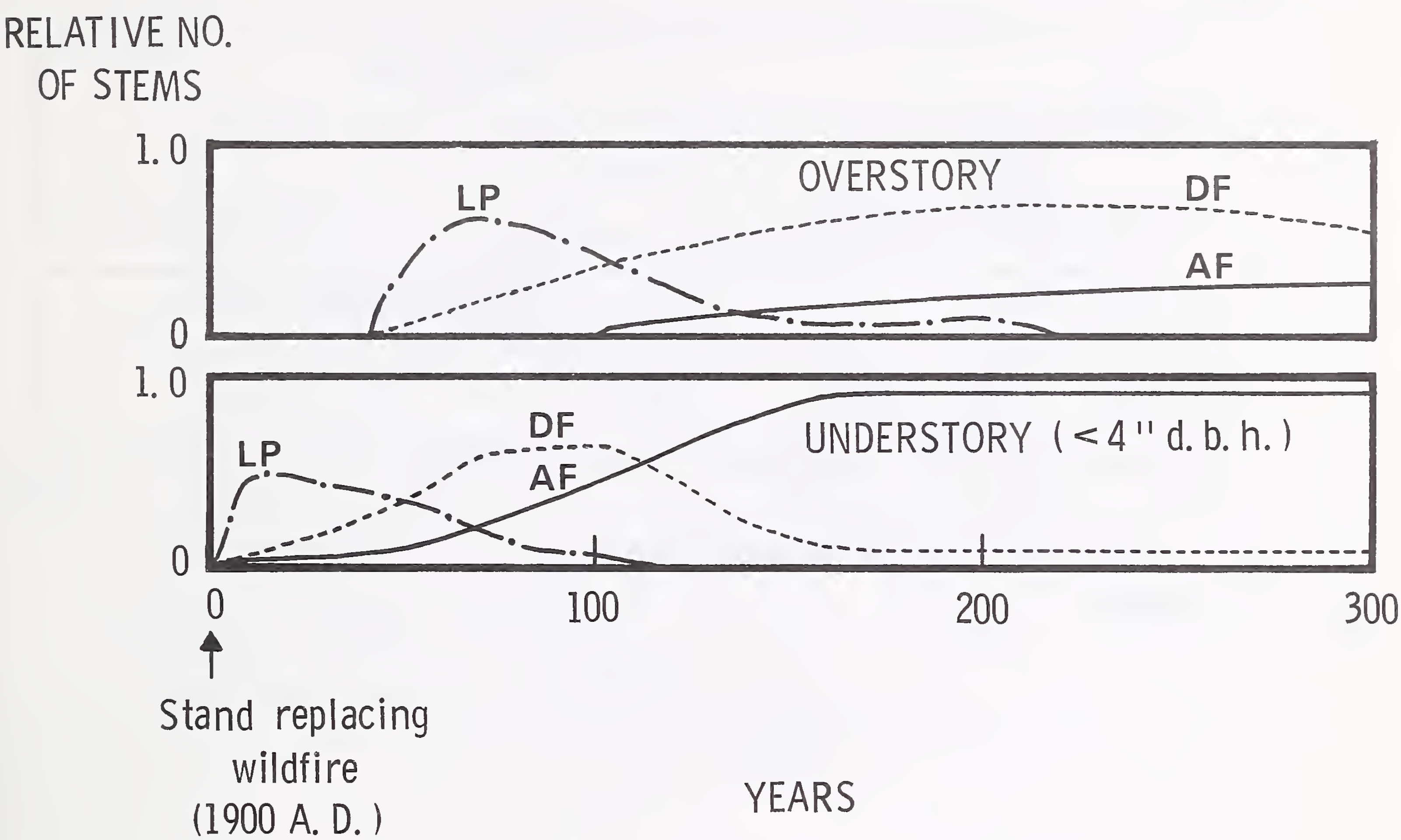
Case 1.—Natural Succession With Pre-1900 Wildfires

The figure shows a pattern of tree succession in a pre-1900 stand in which both stand-replacing fires and lower intensity surface fires occurred at various intervals (Arno 1980). Lodgepole pine (LP) was favored by fires, as was Douglas-fir (DF) to a lesser extent. Subalpine fir (AF), a shade-tolerant species, is killed by any fire and requires more than a century to regain dominance after fire. Most pre-1900 stands had overstories of Douglas-fir and lodgepole pine. Understories contained subalpine fir in addition to the other species. Underburning perpetuated open stands of large Douglas-fir and sometimes western larch. Stand-replacing fires favored lodgepole pine and sometimes larch. (The crown fire reduces the total number of stems to zero, which we have depicted in the relative number of stems.)



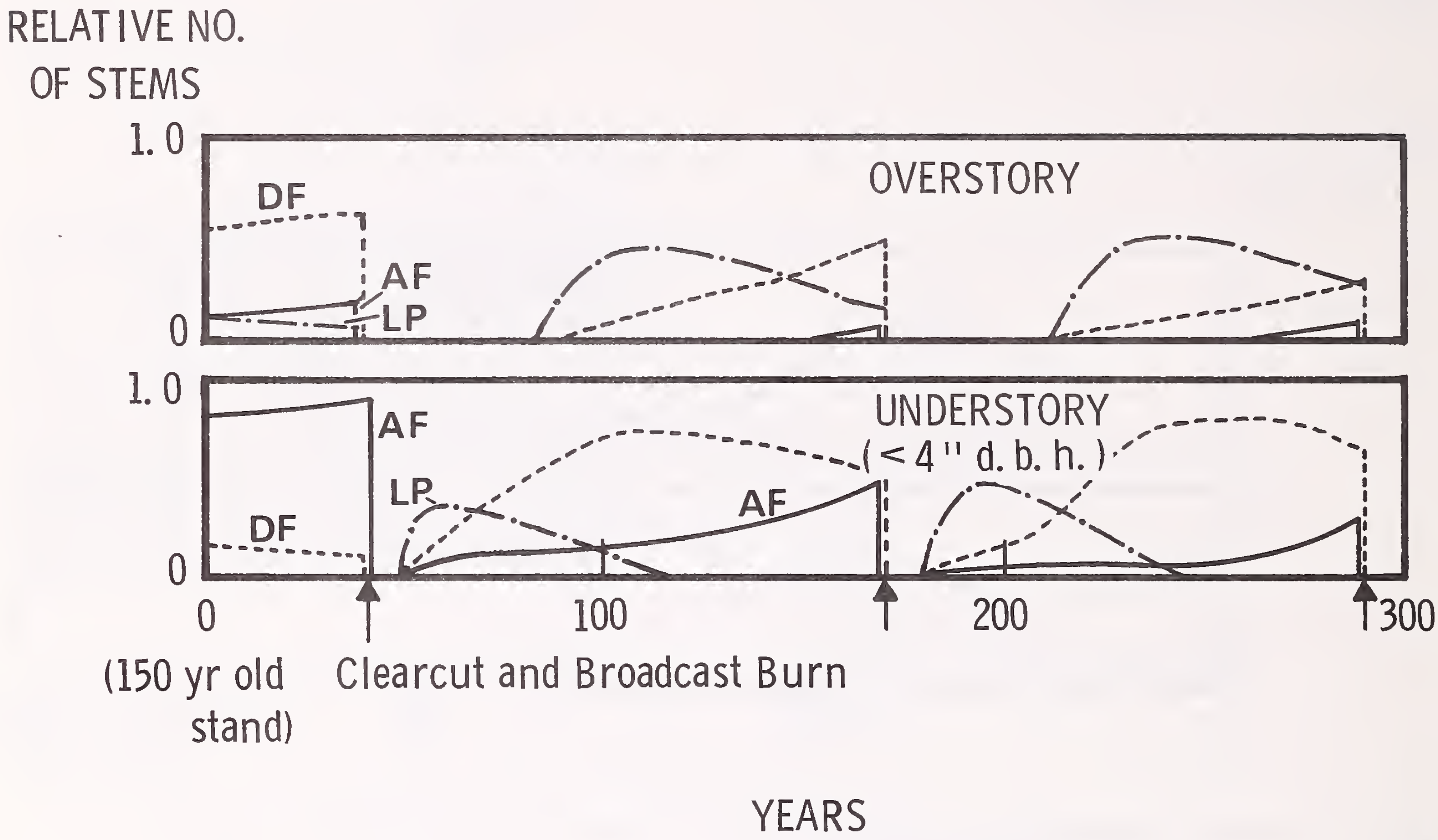
Case 2.—Natural Succession With Fire Suppression and No Cutting

Without disturbances, lodgepole pine fails to regenerate, allowing Douglas-fir to become the overstory dominant 125 to 150 years after the last fire. Subalpine fir becomes the dominant understory and eventually becomes a codominant in the overstory with Douglas-fir. Partial cutting without burning or scarification tends to speed up this natural succession. (The crown fire reduces the total number of stems to zero, which is depicted in the relative number of stems.)



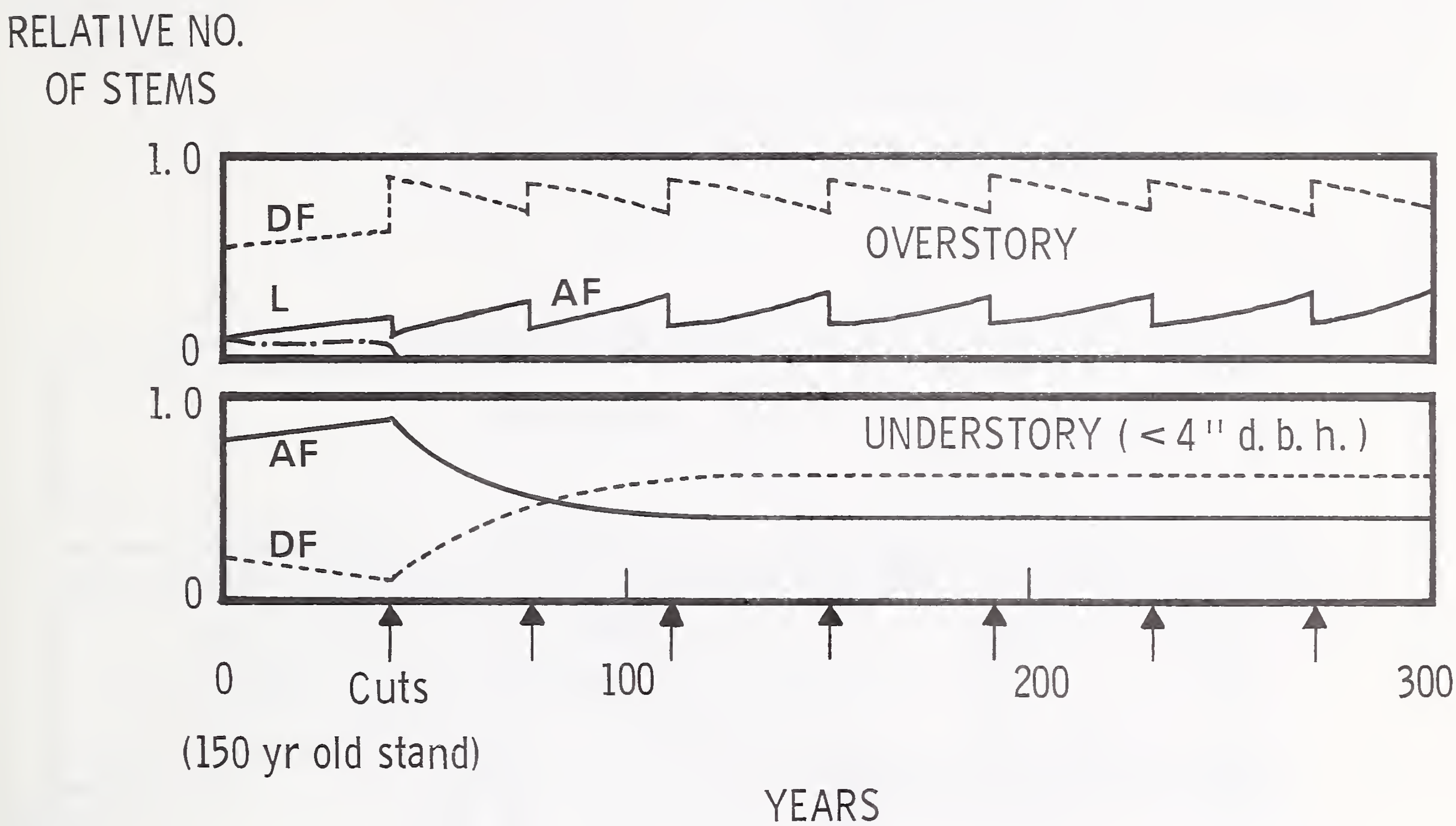
Case 3.—Clearcutting with Broadcast Burning

This treatment is most favorable for lodgepole pine, which increases relative to Douglas-fir through successive rotations. Subalpine fir remains a minor understory component. (The treatment reduces the total number of stems to zero, which is depicted in the relative number of stems.)



Case 4.—Selection Cuttings

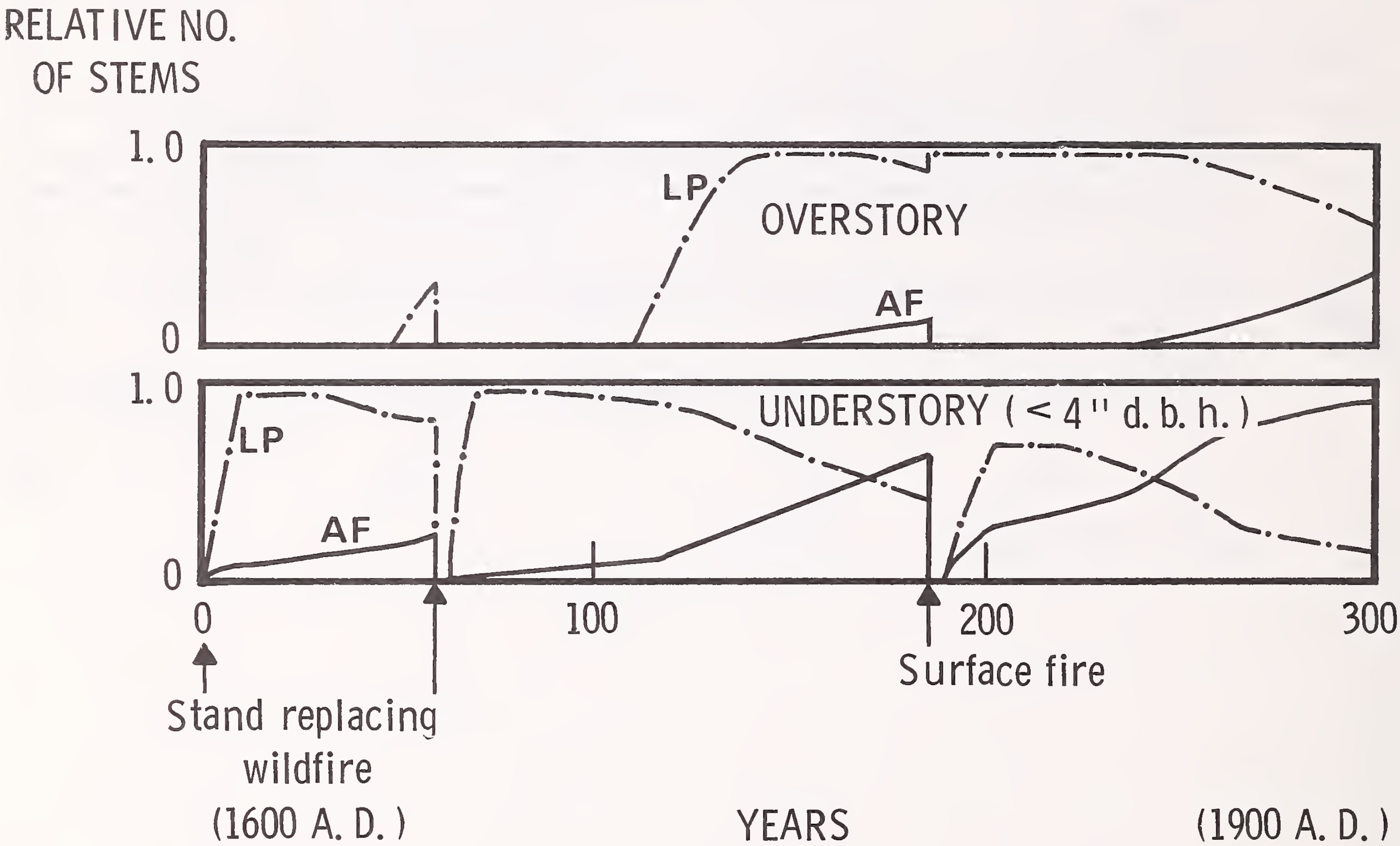
Cuttings are made (at 40-year intervals) to favor Douglas-fir. All subalpine firs greater than 4 inches in d.b.h. are harvested or felled with each cutting in order to remove this seed source. Slash concentrations are burned in piles or jackpots. Douglas-fir (and larch if present) regeneration is benefited by the stand-opening cuts, burned areas, and skid trails. This species' faster growth enables it to maintain overstory dominance over subalpine fir with continued cutting treatments.



APPENDIX D-5.—HYPOTHESIZED TREE SUCCESSION ON THE ABLA/XETE, VASC PHASE

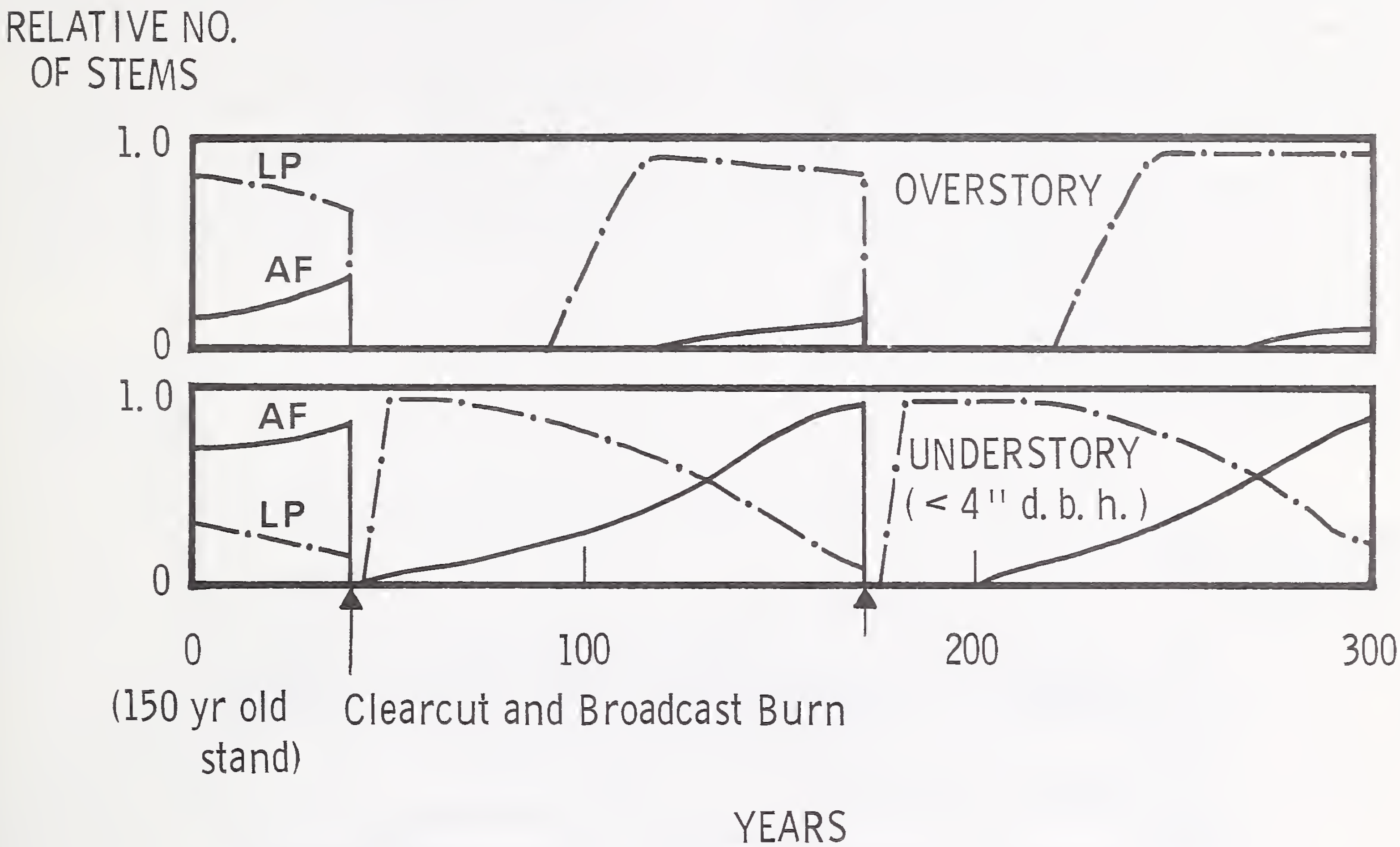
Case 1.—Natural Succession With Pre-1900 Wildfires

Both stand-replacing fires and less intense surface fires occurred at various intervals (Arno 1980). Lodgepole pine was favored by fire treatments, whereas subalpine fir became the climax dominant after 200 years or more without fire. Douglas-fir, Engelmann spruce, and whitebark pine are minor components in this phase that are not shown in this illustration. Fire suppression or partial cutting tends to favor succession to dominance by subalpine fir. (The crown fire reduces the total number of stems to zero, which is depicted in the relative number of stems.)



Case 2.—Clearcutting with Broadcast Burning or Other Site Preparation Treatments

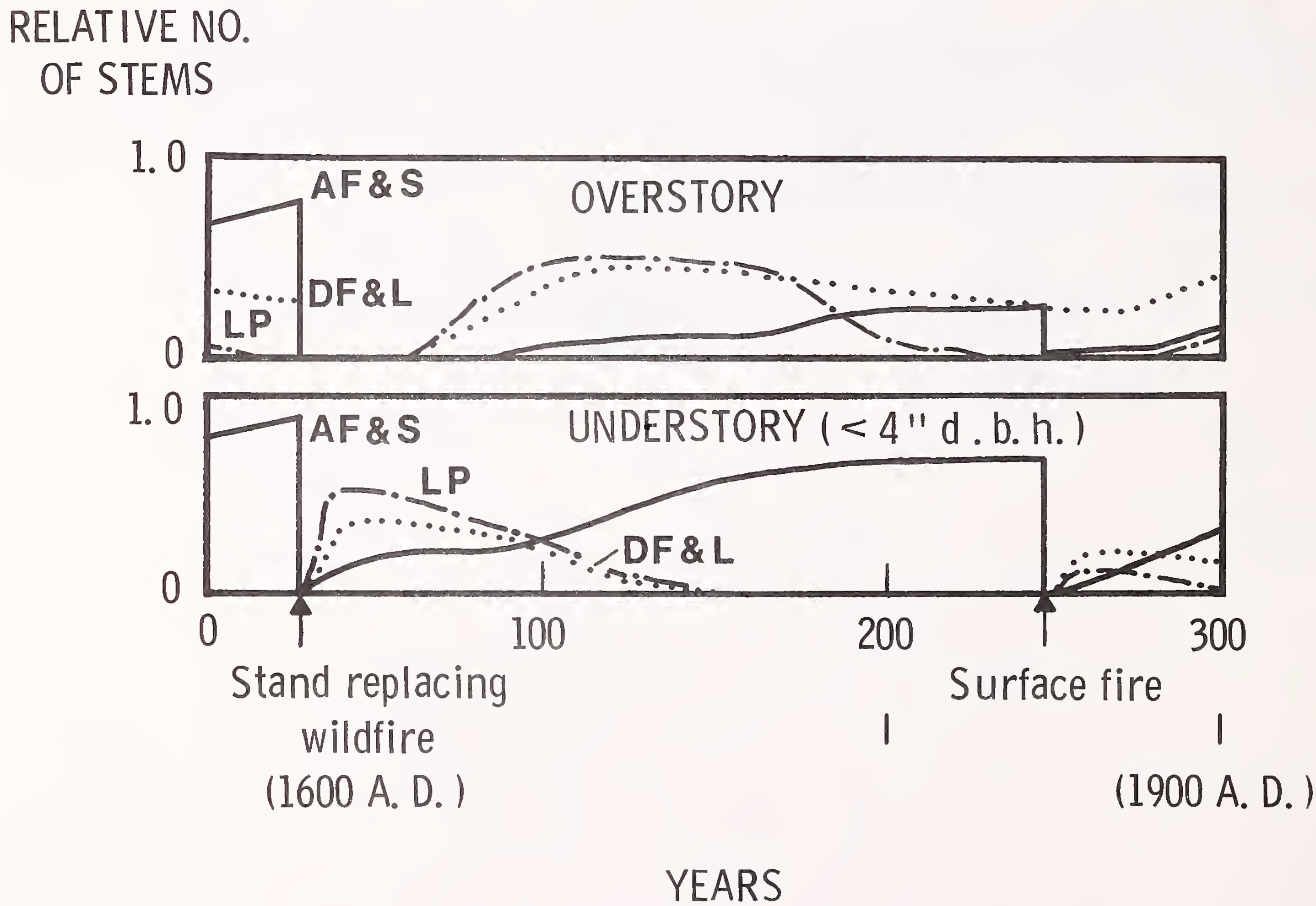
These treatments are made every 130 years, and this results in development of nearly pure lodgepole pine overstories. Clearcutting carried out without burning or site preparation would generally result in stands dominated by lodgepole pine and subalpine fir. (The treatment reduces the total number of stems to zero, which is depicted in the relative number of stems.)



APPENDIX D-6.—HYPOTHESIZED TREE SUCCESSION ON ABLA/MEFE, WARM PHASE

A common successional pattern is depicted for pre-1900 stands. To simplify the diagram, subalpine fir (AF) and Engelmann spruce (S) are combined. (Their successional differences are shown in appendix C-7 representing the cold phase of ABLA/MEFE.) Douglas-fir (DF) and western larch (L) are long-lived intolerant species in this habitat type and are also combined. Two types of wildfires occurred. The stand-replacing fire gave rise to vigorous regeneration of lodgepole pine (LP), DF, and L, with lesser amounts of AF and S. This developed into a dense pole stand of seral species. When the LP component of this stand died (150 to 180 years after the fire), AF and S replaced it. A moderate surface fire occurred in the mature seral forest and killed most of the fire-susceptible trees, leaving the overstory DF, L, and a few S. A modest amount of regeneration of all species, except perhaps L, occurred after the surface fire.

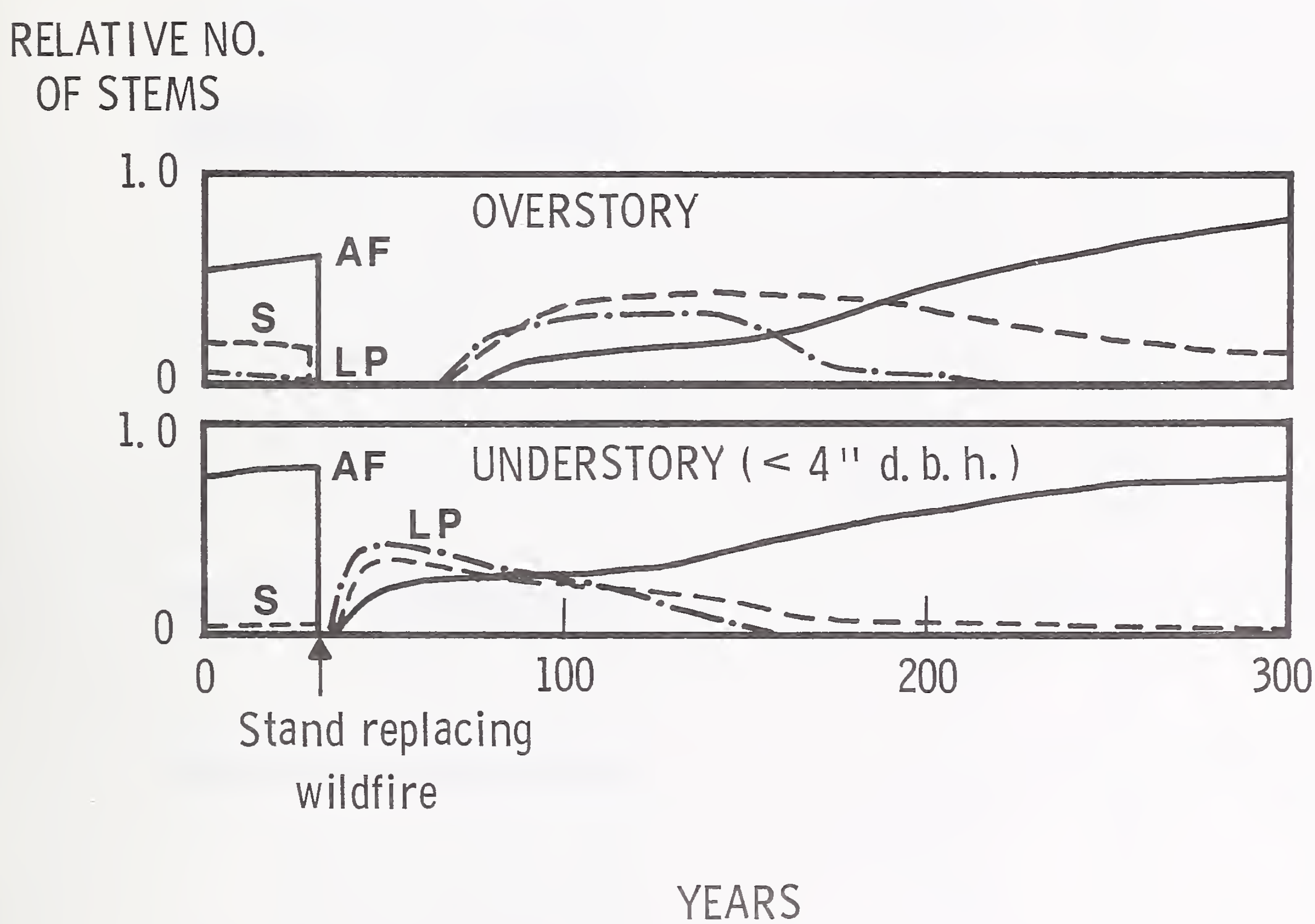
Fire suppression and partial cutting without site preparation will allow subalpine fir to develop into the climax dominant species. The crown fire reduces the total number of stems to zero, which is depicted in the relative number of stems.



APPENDIX D-7.—HYPOTHESIZED TREE SUCCESSION ON ABLA/MEFE, COLD PHASE

A common successional pattern is shown in pre-1900 stands. A stand-replacing fire occurred in a 150-year-old stand having seed from serotinus cones in a few living lodgepole pine (LP) and snags. After the fire, LP and spruce (S) dominate the young stand. LP dies about 150 years after the fire, and subalpine fir (AF) steadily increases in abundance. In the 300-year-old stand (right edge), S is slowly being replaced by the more shade-tolerant AF.

Partial cutting without site preparation would presumably speed up this succession. Clearcutting with site preparation would generally restart this sort of successional pattern, provided that a seed source for the seral species remained. (The crown fire reduces the total number of stems to zero, which is depicted in the relative number of stems.)



APPENDIX E.—SUCCESSION CLASSIFICATION FIELD FORM FOR HABITAT TYPES PSME/PHMA, PSME/VAGL, ABLA/XETE, ABLA/MEFE

OBSERVER:	DATE:	Elevation			
HABITAT TYPE:	Site No.:	Slope			
PHASE:		Aspect			

Canopy Coverage Class codes:	Treatment codes:	Intensity codes:	Location: T____ R____ S____ ¼ sec. ____
0 = absent 2+ = 20 - 25%	NP = Clearcut and no site prep.	L = Light or Low	Description:
T = 1% 3 = 25 - 50%	BB = CC & Broadcast Burn	M = Medium	
1 = 1 - 5% 4 = 50 - 75%	MS = CC & Mechanical Scarification	H = Heavy or High	
2- = 5 - 10% 5 = 75 - 95%	MSB = CC & MS and burning		
2 =10 - 20% 6 = 95 - 100%	WF = Stand replacing wildfire		

			untreated(mature)	treated	treated
		STAND Letter	A	B	C
STAND Characteristics:					
1. Total canopy coverage of all trees (percent)					
2. Average d.b.h. of dominant trees (inches)					
3. Basal area per acre (square feet)					
4. Year of treatment or major disturbance					
5. Treatment Type/Intensity (codes from above)			/	/	/
6. Bare mineral soil exposed (percent)					
TREES: Scientific Names	Abbrev.	Common Names	Coverage codes for overstory/understory (<4" dbh)		
1. Abies lasiocarpa	ABLA	subalpine fir	/	/	/
2. Larix occidentalis	LAOC	western larch	/	/	/
3. Picea engelmannii	PIEN	Engelmann spruce	/	/	/
4. Pinus albicaulis	PIAL	whitebark pine	/	/	/
5. Pinus contorta	PICO	lodgepole pine	/	/	/
6. Pinus ponderosa	PIPO	ponderosa pine	/	/	/
7. Pseudotsuga menziesii	PSME	Douglas fir	/	/	/
8.			/	/	/
SHRUBS and SUBSHRUBS: (Include other species with 5% coverage or greater)				Coverage codes	
1. Acer glabrum	ACGL	mountain maple			
2. Alnus sinuata	ALSI	Sitka alder			
3. Amelanchier alnifolia	AMAL	serviceberry			
4. Ceanothus canguineus	CESA	redstem ceanothus			
5. Ceanothus velutinus	CEVE	evergreen ceanothus			
6. Menziesia ferruginea	MEFE	Menziesia			
7. Physocarpus malvaceus	PHMA	ninebark			
8. Ribes viscosissimum	RIVI	sticky currant			
9. Rubus parviflorus	RUPA	thimbleberry			
10. Salix scouleriana	SASC	Scouler willow			
11. Spiraea belulifolia	SPBE	white spirea			
12. Symphoricarpos albus	SYAL	common snowberry			
13. Vaccinium globulare	VAGL	blue huckleberry			
14. Vaccinium scoparium	VASC	grouse whortleberry			
15.					
16.					
GRASSES: (include other species with 5% coverage or greater)					
1. Calamagrostis rubescens	CARU	pinegrass			
2. Carex geyeri	CAGE	elk sedge			
3. Carex rossii	CARO	Ross sedge			
4. Carex concinnoides	CACO	northwestern sedge			
5.					
FORBS: (include other species with 5% coverage or greater)					
1. Anaphalis margaritacea	ANMA	pearly everlasting			
2. Arnica latifolia	ARLA	broadleaf anica			
3. Chimaphila umbellata	CHUM	prince's pine/pipsissewa			
4. Epilobium angustifolium	EPAN	fireweed			
5. Xerophyllum tenax	XETE	beargrass			
6.					
7.					
WET SITES SPECIES: (include other species with 5% coverage or greater)					
1. Calamagrostis canadensis	CACA	blue joint			
2. wet-site Carex	Carex	wet site sedges			
3. Cinna latifolia	CILA	drooping woodreed			
4. Deschampsia atropurpurea	DEAT	mountain hairgrass			
5. Juncus drummondii	JUDR	Drummond rush			
6. Senecio triangularis	SETR	arrowleaf groundsel			
7. Trollius laxus	TRLA	American globeflower			
8. Veratrum viride	VEVI	white hellebore			
9.					
10.					
		Community Type			

★U.S. GOVERNMENT PRINTING OFFICE: 1985-0-576-040/10525

Arno, Stephen F.; Simmerman, Dennis G.; Keane, Robert E. Forest succession on four habitat types in western Montana. General Technical Report INT-177. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1985. 74 p.

Presents classifications of successional community types on four major forest habitat types in western Montana. Classifications show the sequences of seral community types developing after stand-replacing wildfire and clearcutting with broadcast burning, mechanical scarification, or no followup treatment. Information is provided for associating vegetational response to treatments.

KEYWORDS: forest succession, plant communities, vegetation modeling, forest ecology, fire effects

The Intermountain Station, headquartered in Ogden, Utah, is one of eight regional experiment stations charged with providing scientific knowledge to help resource managers meet human needs and protect forest and range ecosystems.

The Intermountain Station includes the States of Montana, Idaho, Utah, Nevada, and western Wyoming. About 231 million acres, or 85 percent, of the land area in the Station territory are classified as forest and rangeland. These lands include grasslands, deserts, shrublands, alpine areas, and well-stocked forests. They supply fiber for forest industries; minerals for energy and industrial development; and water for domestic and industrial consumption. They also provide recreation opportunities for millions of visitors each year.

Field programs and research work units of the Station are maintained in:

Boise, Idaho

Bozeman, Montana (in cooperation with Montana State University)

Logan, Utah (in cooperation with Utah State University)

Missoula, Montana (in cooperation with the University of Montana)

Moscow, Idaho (in cooperation with the University of Idaho)

Provo, Utah (in cooperation with Brigham Young University)

Reno, Nevada (in cooperation with the University of Nevada)